THE AMERICAN NAUTICAL ALMANAC

FOR THE YEAR

1953

NOTE: See page 3 for changes in this volume

UNITED STATES NAVAL OBSERVATORY
WASHINGTON
D. C.

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FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

STARS

NAME	MAG.	NO.
Acamar	3.1	7
Achernar	0.6	5
Acrux	1.1	30
Adhara	1.6	19
Aldebaran	1.1	10
Alioth	1.7	32
Alkaid	1.9	34
Al Na'ir	2.2	55
Alnilam	1.8	15
Alphard	2.2	25
Alphecca	2.3	41
Alpheratz	2.2	1
Altair	0.9	51
Ankaa	2.4	2
Antares	1.2	42
Arcturus	0.2	37
Atria[1]	1.9	43
Avior[2]	1.7	22
Bellatrix	1.7	13
Betelgeuse	0.1 to 1.2	16
Canopus	−0.9	17
Capella	0.2	12
Deneb	1.3	53
Denebola	2.2	28
Diphda[3]	2.2	4
Dubhe	2.0	27
Elnath	1.8	14
Eltanin[4]	2.4	47
Enif	2.5	54
Fomalhaut	1.3	56
Gacrux[5]	1.6	31
Gienah	2.8	29
Hadar	0.9	35
Hamal	2.2	6
Kaus Australis	2.0	48
Kochab	2.2	40
Markab	2.6	57
Menkar	2.8	8
Menkent[6]	2.3	36
Miaplacidus	1.8	24
Mirfak[7]	1.9	9
Nunki	2.1	50
Peacock	2.1	52
Pollux	1.2	21
Procyon	0.5	20
Rasalhague	2.1	46
Regulus	1.3	26
Rigel	0.3	11
Rigil Kentaurus	0.1	38
Sabik	2.6	44
Schedar	2.5	3
Shaula	1.7	45
Sirius	−1.6	18
Spica	1.2	33
Suhail[8]	2.2	23
Vega	0.1	49
Zubenelgenubi	2.9	39

[1] Formerly Alpha Tri. Aust.
[2] Formerly Epsilon Argus.
[3] Formerly Etamin.
[4] Formerly Gamma Crucis.
[5] Formerly Theta Centauri.
[6] Formerly Marfak.
[7] Formerly Al Suhail.

CORRECTIONS TO OBSERVED ALTITUDES

STARS AND PLANETS

Obs. Alt.	corr'n	Obs. Alt.	corr'n
° ′	′	° ′	′
4 23	−10.9	9 44	−5.4
4 26	−10.8	9 56	−5.3
4 29	−10.7	10 08	−5.2
4 32	−10.6	10 20	−5.1
4 36	−10.5	10 33	−5.0
4 39	−10.4	10 46	−4.9
4 42	−10.3	11 00	−4.8
4 46	−10.2	11 14	−4.7
4 49	−10.1	11 29	−4.6
4 53	−10.0	11 45	−4.5
4 56	−9.9	12 01	−4.4
5 00	−9.8	12 18	−4.3
5 04	−9.7	12 35	−4.2
5 08	−9.6	12 54	−4.1
5 12	−9.5	13 13	−4.0
5 16	−9.4	13 33	−3.9
5 20	−9.3	13 54	−3.8
5 24	−9.2	14 16	−3.7
5 28	−9.1	14 40	−3.6
5 32	−9.0	15 04	−3.5
5 37	−8.9	15 30	−3.4
5 41	−8.8	15 57	−3.3
5 46	−8.7	16 26	−3.2
5 51	−8.6	16 56	−3.1
5 55	−8.5	17 28	−3.0
6 00	−8.4	18 02	−2.9
6 05	−8.3	18 38	−2.8
6 11	−8.2	19 17	−2.7
6 16	−8.1	19 58	−2.6
6 21	−8.0	20 42	−2.5
6 27	−7.9	21 28	−2.4
6 32	−7.8	22 19	−2.3
6 38	−7.7	23 13	−2.2
6 44	−7.6	24 11	−2.1
6 50	−7.5	25 14	−2.0
6 56	−7.4	26 22	−1.9
7 03	−7.3	27 36	−1.8
7 09	−7.2	28 56	−1.7
7 16	−7.1	30 24	−1.6
7 23	−7.0	32 00	−1.5
7 30	−6.9	33 45	−1.4
7 37	−6.8	35 40	−1.3
7 44	−6.7	37 48	−1.2
7 52	−6.6	40 08	−1.1
8 00	−6.5	42 44	−1.0
8 08	−6.4	45 36	−0.9
8 16	−6.3	48 47	−0.8
8 25	−6.2	52 18	−0.7
8 34	−6.1	56 11	−0.6
8 43	−6.0	60 28	−0.5
8 52	−5.9	65 08	−0.4
9 02	−5.8	70 11	−0.3
9 12	−5.7	75 34	−0.2
9 23	−5.6	81 13	−0.1
9 33	−5.5	87 03	0.0
9 44		90 00	

SUN'S LOWER LIMB

Obs. Alt.	corr'n	Obs. Alt.	corr'n
° ′	′	° ′	′
4 22	+4.9	9 39	+10.4
4 25	+5.0	9 51	+10.5
4 28	+5.1	10 03	+10.6
4 31	+5.2	10 15	+10.7
4 34	+5.3	10 27	+10.8
4 37	+5.4	10 40	+10.9
4 41	+5.5	10 54	+11.0
4 44	+5.6	11 08	+11.1
4 48	+5.7	11 23	+11.2
4 51	+5.8	11 38	+11.3
4 55	+5.9	11 54	+11.4
4 58	+6.0	12 10	+11.5
5 02	+6.1	12 28	+11.6
5 06	+6.2	12 46	+11.7
5 10	+6.3	13 05	+11.8
5 14	+6.4	13 24	+11.9
5 18	+6.5	13 45	+12.0
5 22	+6.6	14 07	+12.1
5 26	+6.7	14 30	+12.2
5 31	+6.8	14 54	+12.3
5 35	+6.9	15 19	+12.4
5 39	+7.0	15 46	+12.5
5 44	+7.1	16 14	+12.6
5 49	+7.2	16 44	+12.7
5 53	+7.3	17 15	+12.8
5 58	+7.4	17 48	+12.9
6 03	+7.5	18 24	+13.0
6 08	+7.6	19 01	+13.1
6 13	+7.7	19 42	+13.2
6 19	+7.8	20 25	+13.3
6 24	+7.9	21 11	+13.4
6 30	+8.0	22 00	+13.5
6 35	+8.1	22 54	+13.6
6 41	+8.2	23 51	+13.7
6 47	+8.3	24 53	+13.8
6 53	+8.4	26 00	+13.9
7 00	+8.5	27 13	+14.0
7 06	+8.6	28 33	+14.1
7 13	+8.7	30 00	+14.2
7 19	+8.8	31 35	+14.3
7 26	+8.9	33 20	+14.4
7 34	+9.0	35 17	+14.5
7 41	+9.1	37 26	+14.6
7 49	+9.2	39 50	+14.7
7 56	+9.3	42 31	+14.8
8 04	+9.4	45 31	+14.9
8 13	+9.5	48 55	+15.0
8 21	+9.6	52 44	+15.1
8 30	+9.7	57 02	+15.2
8 39	+9.8	61 51	+15.3
8 48	+9.9	67 17	+15.4
8 58	+10.0	73 16	+15.5
9 08	+10.1	79 43	+15.6
9 18	+10.2	86 32	+15.7
9 28	+10.3	90 00	
9 39			

HEIGHT OF EYE

Feet	corr'n	Feet	corr'n
	′		′
1.0	−1.0	46	−6.5
1.2	−1.1	47	−6.6
1.4	−1.2	49	−6.7
1.7	−1.3	50	−6.8
2.0	−1.4	52	−6.9
2.3	−1.5	53	−7.0
2.6	−1.6	55	−7.1
3.0	−1.7	56	−7.2
3.4	−1.8	58	−7.3
3.8	−1.9	60	−7.4
4.2	−2.0	61	−7.5
4.6	−2.1	63	−7.6
5.1	−2.2	65	−7.7
5.5	−2.3	66	−7.8
6.1	−2.4	68	−7.9
6.6	−2.5	70	−8.0
7.2	−2.6	72	−8.1
7.8	−2.7	74	−8.2
8.4	−2.8	75	−8.3
9.0	−2.9	77	−8.4
9.6	−3.0	79	−8.5
10.3	−3.1	81	−8.6
11.0	−3.2	83	−8.7
11.7	−3.3	85	−8.8
12.4	−3.4	87	−8.9
13.2	−3.5	89	−9.0
14.0	−3.6	91	−9.1
14.8	−3.7	93	−9.2
15.6	−3.8	95	−9.3
16.4	−3.9	97	−9.4
17.3	−4.0	99	−9.5
18.2	−4.1	101	−9.6
19.1	−4.2	103	−9.7
20.0	−4.3	105	−9.8
21	−4.4	107	−9.9
22	−4.5	110	−10.0
23	−4.6	112	−10.1
24	−4.7	114	−10.2
25	−4.8	116	−10.3
26	−4.9	119	−10.4
27	−5.0	121	−10.5
28	−5.1	123	−10.6
29	−5.2	126	−10.7
30	−5.3	128	−10.8
31	−5.4	130	−10.9
33	−5.5	133	−11.0
34	−5.6	135	−11.1
35	−5.7	138	−11.2
36	−5.8	140	−11.3
38	−5.9	143	−11.4
39	−6.0	145	−11.5
40	−6.1	148	−11.6
42	−6.2	150	−11.7
43	−6.3	153	−11.8
44	−6.4	156	−11.9
46		158	

When an observed altitude, or the height of eye, corresponds exactly to a printed value, use the upper of the two possible corrections. For Venus, Mars, and the Sun's lower limb, apply also the additional corrections on the daily pages. For the Moon, see back cover. For the Sun's upper limb, and bubble sextant observations, see page 250.

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STARS

Numerical Order					Order of SHA			
No.	Name	Mag.	SHA	Dec.	SHA	Dec.	No.	Name
			°	°	°	°		
1	Alpheratz	2.2	359	+29	14	+15	57	Markab
2	Ankaa	2.4	354	−42	16	−30	56	Fomalhaut
3	Schedar	2.5	351	+56	29	−47	55	Al Na'ir
4	Diphda[1]	2.2	350	−18	35	+10	54	Enif
5	Achernar	0.6	336	−57	50	+45	53	Deneb
6	Hamal	2.2	329	+23	55	−57	52	Peacock
7	Acamar	3.1	316	−40	63	+ 9	51	Altair
8	Menkar	2.8	315	+ 4	77	−26	50	Nunki
9	Mirfak[2]	1.9	310	+50	81	+39	49	Vega
10	Aldebaran	1.1	292	+16	85	−34	48	Kaus Aust.
11	Rigel	0.3	282	− 8	91	+51	47	Eltanin[8]
12	Capella	0.2	282	+46	97	+13	46	Rasalhague
13	Bellatrix	1.7	279	+ 6	97	−37	45	Shaula
14	Elnath	1.8	279	+28	103	−16	44	Sabik
15	Alnilam	1.8	277	− 1	109	−69	43	Atria[7]
16	Betelgeuse	0.1 to 1.2	272	+ 7	113	−26	42	Antares
17	Canopus	−0.9	264	−53	127	+27	41	Alphecca
18	Sirius	−1.6	259	−17	137	+74	40	Kochab
19	Adhara	1.6	256	−28	138	−16	39	Zubenelgenubi
20	Procyon	0.5	246	+ 5	141	−61	38	Rigil Kent.
21	Pollux	1.2	244	+28	147	+19	37	Arcturus
22	Avior[3]	1.7	235	−59	149	−36	36	Menkent[6]
23	Suhail[4]	2.2	223	−43	150	−60	35	Hadar
24	Miaplacidus	1.8	222	−70	154	+50	34	Alkaid
25	Alphard	2.2	219	− 8	159	−11	33	Spica
26	Regulus	1.3	209	+12	167	+56	32	Alioth
27	Dubhe	2.0	195	+62	173	−57	31	Gacrux[5]
28	Denebola	2.2	183	+15	174	−63	30	Acrux
29	Gienah	2.8	177	−17	177	−17	29	Gienah
30	Acrux	1.1	174	−63	183	+15	28	Denebola
31	Gacrux[5]	1.6	173	−57	195	+62	27	Dubhe
32	Alioth	1.7	167	+56	209	+12	26	Regulus
33	Spica	1.2	159	−11	219	− 8	25	Alphard
34	Alkaid	1.9	154	+50	222	−70	24	Miaplacidus
35	Hadar	0.9	150	−60	223	−43	23	Suhail[4]
36	Menkent[6]	2.3	149	−36	235	−59	22	Avior[3]
37	Arcturus	0.2	147	+19	244	+28	21	Pollux
38	Rigil Kentaurus	0.1	141	−61	246	+ 5	20	Procyon
39	Zubenelgenubi	2.9	138	−16	256	−29	19	Adhara
40	Kochab	2.2	137	+74	259	−17	18	Sirius
41	Alphecca	2.3	127	+27	264	−53	17	Canopus
42	Antares	1.2	113	−26	272	+ 7	16	Betelgeuse
43	Atria[7]	1.9	109	−69	277	− 1	15	Alnilam
44	Sabik	2.6	103	−16	279	+29	14	Elnath
45	Shaula	1.7	97	−37	279	+ 6	13	Bellatrix
46	Rasalhague	2.1	97	+13	282	+46	12	Capella
47	Eltanin[8]	2.4	91	+51	282	− 8	11	Rigel
48	Kaus Australis	2.0	85	−34	292	+16	10	Aldebaran
49	Vega	0.1	81	+39	310	+50	9	Mirfak[2]
50	Nunki	2.1	77	−26	315	+ 4	8	Menkar
51	Altair	0.9	63	+ 9	316	−40	7	Acamar
52	Peacock	2.1	55	−57	329	+23	6	Hamal
53	Deneb	1.3	50	+45	336	−57	5	Achernar
54	Enif	2.5	35	+10	350	−18	4	Diphda[1]
55	Al Na'ir	2.2	29	−47	351	+56	3	Schedar
56	Fomalhaut	1.3	16	−30	354	−42	2	Ankaa
57	Markab	2.6	14	+15	359	+29	1	Alpheratz

[1] Formerly Deneb Kaitos.
[2] Formerly Marfak.
[3] Formerly Epsilon Argus.
[4] Formerly Al Suhail.
[5] Formerly Gamma Crucis.
[6] Formerly Theta Centauri.
[7] Formerly Alpha Tri. Aust.
[8] Formerly Etamin.

STARS

NAME	MAG.	NO.
Acamar	3.1	7
Achernar	0.6	5
Acrux	1.1	30
Adhara	1.6	19
Aldebaran	1.1	10
Alioth	1.7	32
Alkaid	1.9	34
Al Na'ir	2.2	55
Alnilam	1.8	15
Alphard	2.2	25
Alphecca	2.3	41
Alpheratz	2.2	1
Altair	0.9	51
Ankaa	2.4	2
Antares	1.2	42
Arcturus	0.2	37
Atria[1]	1.9	43
Avior[2]	1.7	22
Bellatrix	1.7	13
Betelgeuse	0.1 to 1.2	16
Canopus	−0.9	17
Capella	0.2	12
Deneb	1.3	53
Denebola	2.2	28
Diphda[3]	2.2	4
Dubhe	2.0	27
Elnath	1.8	14
Eltanin[4]	2.4	47
Enif	2.5	54
Fomalhaut	1.3	56
Gacrux[5]	1.6	31
Gienah	2.8	29
Hadar	0.9	35
Hamal	2.2	6
Kaus Australis	2.0	48
Kochab	2.2	40
Markab	2.6	57
Menkar	2.8	8
Menkent[6]	2.3	36
Miaplacidus	1.8	24
Mirfak[7]	1.9	9
Nunki	2.1	50
Peacock	2.1	52
Pollux	1.2	21
Procyon	0.5	20
Rasalhague	2.1	46
Regulus	1.3	26
Rigel	0.3	11
Rigil Kentaurus	0.1	38
Sabik	2.6	44
Schedar	2.5	3
Shaula	1.7	45
Sirius	−1.6	18
Spica	1.2	33
Suhail[8]	2.2	23
Vega	0.1	49
Zubenelgenubi	2.9	39

[1] Formerly Alpha Tri. Aust.
[2] Formerly Epsilon Argus.
[3] Formerly Deneb Kaitos.
[4] Formerly Etamin.
[5] Formerly Gamma Crucis.
[6] Formerly Theta Centauri.
[7] Formerly Marfak.
[8] Formerly Al Suhail.

CORRECTIONS TO OBSERVED ALTITUDES

STARS AND PLANETS

Obs. Alt.	corr'n	Obs. Alt.	corr'n
° ′	′	° ′	′
4 23	−10.9	9 44	−5.4
4 26	−10.8	9 56	−5.3
4 29	−10.7	10 08	−5.2
4 32	−10.6	10 20	−5.1
4 36	−10.5	10 33	−5.0
4 39	−10.4	10 46	−4.9
4 42	−10.3	11 00	−4.8
4 46	−10.2	11 14	−4.7
4 49	−10.1	11 29	−4.6
4 53	−10.0	11 45	−4.5
4 56	−9.9	12 01	−4.4
5 00	−9.8	12 18	−4.3
5 04	−9.7	12 35	−4.2
5 08	−9.6	12 54	−4.1
5 12	−9.5	13 13	−4.0
5 16	−9.4	13 33	−3.9
5 20	−9.3	13 54	−3.8
5 24	−9.2	14 16	−3.7
5 28	−9.1	14 40	−3.6
5 32	−9.0	15 04	−3.5
5 37	−8.9	15 30	−3.4
5 41	−8.8	15 57	−3.3
5 46	−8.7	16 26	−3.2
5 51	−8.6	16 56	−3.1
5 55	−8.5	17 28	−3.0
6 00	−8.4	18 02	−2.9
6 05	−8.3	18 38	−2.8
6 11	−8.2	19 17	−2.7
6 16	−8.1	19 58	−2.6
6 21	−8.0	20 42	−2.5
6 27	−7.9	21 28	−2.4
6 32	−7.8	22 19	−2.3
6 38	−7.7	23 13	−2.2
6 44	−7.6	24 11	−2.1
6 50	−7.5	25 14	−2.0
6 56	−7.4	26 22	−1.9
7 03	−7.3	27 36	−1.8
7 09	−7.2	28 56	−1.7
7 16	−7.1	30 24	−1.6
7 23	−7.0	32 00	−1.5
7 30	−6.9	33 45	−1.4
7 37	−6.8	35 40	−1.3
7 44	−6.7	37 48	−1.2
7 52	−6.6	40 08	−1.1
8 00	−6.5	42 44	−1.0
8 08	−6.4	45 36	−0.9
8 16	−6.3	48 47	−0.8
8 25	−6.2	52 18	−0.7
8 34	−6.1	56 11	−0.6
8 43	−6.0	60 28	−0.5
8 52	−5.9	65 08	−0.4
9 02	−5.8	70 11	−0.3
9 12	−5.7	75 34	−0.2
9 23	−5.6	81 13	−0.1
9 33	−5.5	87 03	0.0
9 44		90 00	

SUN'S LOWER LIMB

Obs. Alt.	corr'n	Obs. Alt.	corr'n
° ′	′	° ′	′
4 22	+4.9	9 39	+10.4
4 25	+5.0	9 51	+10.5
4 28	+5.1	10 03	+10.6
4 31	+5.2	10 15	+10.7
4 34	+5.3	10 27	+10.8
4 37	+5.4	10 40	+10.9
4 41	+5.5	10 54	+11.0
4 44	+5.6	11 08	+11.1
4 48	+5.7	11 23	+11.2
4 51	+5.8	11 38	+11.3
4 55	+5.9	11 54	+11.4
4 58	+6.0	12 10	+11.5
5 02	+6.1	12 28	+11.6
5 06	+6.2	12 46	+11.7
5 10	+6.3	13 05	+11.8
5 14	+6.4	13 24	+11.9
5 18	+6.5	13 45	+12.0
5 22	+6.6	14 07	+12.1
5 26	+6.7	14 30	+12.2
5 31	+6.8	14 54	+12.3
5 35	+6.9	15 19	+12.4
5 39	+7.0	15 46	+12.5
5 44	+7.1	16 14	+12.6
5 49	+7.2	16 44	+12.7
5 53	+7.3	17 15	+12.8
5 58	+7.4	17 48	+12.9
6 03	+7.5	18 24	+13.0
6 08	+7.6	19 01	+13.1
6 13	+7.7	19 42	+13.2
6 19	+7.8	20 25	+13.3
6 24	+7.9	21 11	+13.4
6 30	+8.0	22 00	+13.5
6 35	+8.1	22 54	+13.6
6 41	+8.2	23 51	+13.7
6 47	+8.3	24 53	+13.8
6 53	+8.4	26 00	+13.9
7 00	+8.5	27 13	+14.0
7 06	+8.6	28 33	+14.1
7 13	+8.7	30 00	+14.2
7 19	+8.8	31 35	+14.3
7 26	+8.9	33 20	+14.4
7 34	+9.0	35 17	+14.5
7 41	+9.1	37 26	+14.6
7 49	+9.2	39 50	+14.7
7 56	+9.3	42 31	+14.8
8 04	+9.4	45 31	+14.9
8 13	+9.5	48 55	+15.0
8 21	+9.6	52 44	+15.1
8 30	+9.7	57 02	+15.2
8 39	+9.8	61 51	+15.3
8 48	+9.9	67 17	+15.4
8 58	+10.0	73 16	+15.5
9 08	+10.1	79 43	+15.6
9 18	+10.2	86 32	+15.7
9 28	+10.3	90 00	
9 39			

HEIGHT OF EYE

Feet	corr'n	Feet	corr'n
	′		′
1.0	−1.0	46	−6.5
1.2	−1.1	47	−6.6
1.4	−1.2	49	−6.7
1.7	−1.3	50	−6.8
2.0	−1.4	52	−6.9
2.3	−1.5	53	−7.0
2.6	−1.6	55	−7.1
3.0	−1.7	56	−7.2
3.4	−1.8	58	−7.3
3.8	−1.9	60	−7.4
4.2	−2.0	61	−7.5
4.6	−2.1	63	−7.6
5.1	−2.2	65	−7.7
5.5	−2.3	66	−7.8
6.1	−2.4	68	−7.9
6.6	−2.5	70	−8.0
7.2	−2.6	72	−8.1
7.8	−2.7	74	−8.2
8.4	−2.8	75	−8.3
9.0	−2.9	77	−8.4
9.6	−3.0	79	−8.5
10.3	−3.1	81	−8.6
11.0	−3.2	83	−8.7
11.7	−3.3	85	−8.8
12.4	−3.4	87	−8.9
13.2	−3.5	89	−9.0
14.0	−3.6	91	−9.1
14.8	−3.7	93	−9.2
15.6	−3.8	95	−9.3
16.4	−3.9	97	−9.4
17.3	−4.0	99	−9.5
18.2	−4.1	101	−9.6
19.1	−4.2	103	−9.7
20.0	−4.3	105	−9.8
21	−4.4	107	−9.9
22	−4.5	110	−10.0
23	−4.6	112	−10.1
24	−4.7	114	−10.2
25	−4.8	116	−10.3
26	−4.9	119	−10.4
27	−5.0	121	−10.5
28	−5.1	123	−10.6
29	−5.2	126	−10.7
30	−5.3	128	−10.8
31	−5.4	130	−10.9
33	−5.5	133	−11.0
34	−5.6	135	−11.1
35	−5.7	138	−11.2
36	−5.8	140	−11.3
38	−5.9	143	−11.4
39	−6.0	145	−11.5
40	−6.1	148	−11.6
42	−6.2	150	−11.7
43	−6.3	153	−11.8
44	−6.4	156	−11.9
46		158	

When an observed altitude, or the height of eye, corresponds exactly to a printed value, use the upper of the two possible corrections. For Venus, Mars, and the Sun's lower limb, apply also the additional corrections on the daily pages. For the Moon, see back cover. For the Sun's upper limb, and bubble sextant observations, see page 250.

THE AMERICAN NAUTICAL ALMANAC

FOR THE YEAR 1953

ISSUED BY THE NAUTICAL ALMANAC OFFICE
UNITED STATES NAVAL OBSERVATORY
UNDER THE AUTHORITY OF THE
SECRETARY OF THE NAVY

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April 1951.

PREFACE

This volume of the *American Nautical Almanac* was prepared under the immediate supervision of G. M. Clemence and Glen H. Draper. The nature and arrangement of the material are the same as in the volume for 1952, with the following exceptions. The names of the stars have been added to the list (now in alphabetical order) on the daily pages, and the time of meridian transit is omitted. In order to eliminate variations of usage, the list of 57 stars has been revised, and a few of the names have been altered, as noted on the inside front cover. A more extensive list is given on pages 254–259. The designation GMT (Greenwich mean time) is used in this volume with exactly the meaning formerly attached to GCT (Greenwich civil time).

The object of the volume is to provide in convenient form the astronomical data required by mariners; that is, the Greenwich hour angle and declination of the celestial bodies used in navigation. These can always be found with two openings of the book, one (in the white section) for the hour and the other (in the yellow section) for the minute of observation. Each result is obtained as the sum of two or of three quantities, without interpolation.

The altitude corrections are obtained without interpolation; and the parallax and semidiameter of the Moon are not needed.

An explanation of the use of the *Almanac* is given near the end of the white section. This is followed by tables for finding the latitude by Polaris.

G. W. Welker,
Captain, U. S. Navy,
Superintendent Naval Observatory.

Washington, *April 1951.*

GMT	♈ GHA	VENUS −3.8 GHA	Dec.	MARS 1.2 GHA	Dec.	JUPITER −2.2 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
1 0	100 20.9	132 35.3	−14 48.5	127 04.6	−12 08.0	61 24.5	+14 04.3	255 08.1	− 7 51.8	349 14.3	107	+24 07.2	− 70
1	115 23.4	147 35.0	47.4	142 05.3	07.3	76 27.0	04.3	270 10.4	51.8	3 44.0	108	24 00.2	− 71
2	130 25.8	162 34.7	46.3	157 05.9	06.6	91 29.5	04.3	285 12.7	51.9	18 13.8	109	23 53.1	− 72
3	145 28.3	177 34.4	•• 45.3	172 06.5	•• 05.9	106 32.0	•• 04.3	300 15.0	•• 51.9	32 43.7	109	•23 45.9	− 73
4	160 30.8	192 34.1	44.2	187 07.2	05.1	121 34.5	04.3	315 17.4	52.0	47 13.6	110	23 38.6	− 74
5	175 33.2	207 33.8	43.1	202 07.8	04.4	136 37.0	04.3	330 19.7	52.0	61 43.6	111	23 31.2	− 75
6	190 35.7	222 33.5	−14 42.0	217 08.4	−12 03.7	151 39.5	+14 04.3	345 22.0	− 7 52.1	76 13.7	112	+23 23.7	− 77
7	205 38.1	237 33.3	40.9	232 09.1	03.0	166 42.0	04.3	0 24.3	52.1	90 43.9	113	23 16.0	− 77
8	220 40.6	252 33.0	39.9	247 09.7	02.3	181 44.5	04.3	15 26.6	52.1	105 14.2	113	23 08.3	− 79
9	235 43.1	267 32.7	•• 38.8	262 10.3	•• 01.6	196 47.0	•• 04.3	30 29.0	•• 52.2	119 44.5	114	•23 00.4	− 79
10	250 45.5	282 32.4	37.7	277 11.0	00.8	211 49.6	04.3	45 31.3	52.2	134 14.9	115	22 52.5	− 81
11	265 48.0	297 32.1	36.6	292 11.6	12 00.1	226 52.1	04.3	60 33.6	52.3	148 45.4	116	22 44.4	− 81
12	280 50.5	312 31.8	−14 35.5	307 12.3	−11 59.4	241 54.6	+14 04.3	75 35.9	− 7 52.3	163 16.0	117	+22 36.3	− 83
13	295 52.9	327 31.5	34.5	322 12.9	58.7	256 57.1	04.3	90 38.3	52.4	177 46.7	118	22 28.0	− 83
14	310 55.4	342 31.3	33.4	337 13.5	58.0	271 59.6	04.3	105 40.6	52.4	192 17.5	118	22 19.7	− 85
15	325 57.9	357 31.0	•• 32.3	352 14.2	•• 57.2	287 02.1	•• 04.3	120 42.9	•• 52.4	206 48.3	119	•22 11.2	− 85
16	341 00.3	12 30.7	31.2	7 14.8	56.5	302 04.6	04.3	135 45.2	52.5	221 19.2	120	22 02.7	− 87
17	356 02.8	27 30.4	30.1	22 15.4	55.8	317 07.1	04.3	150 47.6	52.5	235 50.2	121	21 54.0	− 87
18	11 05.3	42 30.1	−14 29.0	37 16.1	−11 55.1	332 09.5	+14 04.3	165 49.9	− 7 52.6	250 21.3	121	+21 45.3	− 88
19	26 07.7	57 29.8	27.9	52 16.7	54.4	347 12.0	04.3	180 52.2	52.6	264 52.4	123	21 36.5	− 90
20	41 10.2	72 29.6	26.9	67 17.4	53.6	2 14.5	04.3	195 54.5	52.7	279 23.7	123	21 27.5	− 90
21	56 12.6	87 29.3	•• 25.8	82 18.0	•• 52.9	17 17.0	•• 04.3	210 56.8	•• 52.7	293 55.0	124	•21 18.5	− 91
22	71 15.1	102 29.0	24.7	97 18.6	52.2	32 19.5	04.3	225 59.2	52.7	308 26.4	125	21 09.4	− 92
23	86 17.6	117 28.7	23.6	112 19.3	51.5	47 22.0	04.3	241 01.5	52.8	322 57.9	126	21 00.2	− 93
2 0	101 20.0	132 28.5	−14 22.5	127 19.9	−11 50.8	62 24.5	+14 04.3	256 03.8	− 7 52.8	337 29.5	126	+20 50.9	− 93
1	116 22.5	147 28.2	21.4	142 20.5	50.0	77 27.0	04.3	271 06.1	52.9	352 01.1	128	20 41.6	− 95
2	131 25.0	162 27.9	20.3	157 21.2	49.3	92 29.5	04.3	286 08.5	52.9	6 32.9	128	20 32.1	− 95
3	146 27.4	177 27.6	•• 19.2	172 21.8	•• 48.6	107 32.0	•• 04.3	301 10.8	•• 53.0	21 04.7	129	•20 22.6	− 97
4	161 29.9	192 27.4	18.1	187 22.5	47.9	122 34.5	04.3	316 13.1	53.0	35 36.6	129	20 12.9	− 97
5	176 32.4	207 27.1	17.1	202 23.1	47.1	137 37.0	04.3	331 15.4	53.0	50 08.5	131	20 03.2	− 98
6	191 34.8	222 26.8	−14 16.0	217 23.7	−11 46.4	152 39.5	+14 04.3	346 17.8	− 7 53.1	64 40.6	131	+19 53.4	− 98
7	206 37.3	237 26.5	14.9	232 24.4	45.7	167 42.0	04.3	1 20.1	53.1	79 12.7	132	19 43.6	−100
8	221 39.8	252 26.3	13.8	247 25.0	45.0	182 44.5	04.3	16 22.4	53.2	93 44.9	133	19 33.6	−100
9	236 42.2	267 26.0	•• 12.7	262 25.7	•• 44.3	197 47.0	•• 04.4	31 24.7	•• 53.2	108 17.2	134	•19 23.6	−101
10	251 44.7	282 25.7	11.6	277 26.3	43.5	212 49.5	04.4	46 27.1	53.3	122 49.6	134	19 13.5	−102
11	266 47.1	297 25.5	10.5	292 26.9	42.8	227 52.0	04.4	61 29.4	53.3	137 22.0	136	19 03.3	−103
12	281 49.6	312 25.2	−14 09.4	307 27.6	−11 42.1	242 54.5	+14 04.4	76 31.7	− 7 53.3	151 54.6	136	+18 53.0	−103
13	296 52.1	327 24.9	08.3	322 28.2	41.4	257 57.0	04.4	91 34.1	53.4	166 27.2	136	18 42.7	−104
14	311 54.5	342 24.7	07.2	337 28.9	40.6	272 59.4	04.4	106 36.4	53.4	180 59.8	138	18 32.3	−105
15	326 57.0	357 24.4	•• 06.1	352 29.5	•• 39.9	288 01.9	•• 04.4	121 38.7	•• 53.5	195 32.6	138	•18 21.8	−105
16	341 59.5	12 24.1	05.0	7 30.1	39.2	303 04.4	04.4	136 41.0	53.5	210 05.4	139	18 11.3	−107
17	357 01.9	27 23.9	03.9	22 30.8	38.5	318 06.9	04.4	151 43.4	53.5	224 38.3	140	18 00.6	−106
18	12 04.4	42 23.6	−14 02.8	37 31.4	−11 37.7	333 09.4	+14 04.4	166 45.7	− 7 53.6	239 11.3	140	+17 50.0	−108
19	27 06.9	57 23.4	01.7	52 32.1	37.0	348 11.9	04.4	181 48.0	53.6	253 44.3	141	17 39.2	−108
20	42 09.3	72 23.1	14 00.6	67 32.7	36.3	3 14.4	04.4	196 50.3	53.7	268 17.4	142	17 28.4	−109
21	57 11.8	87 22.8	•13 59.5	82 33.3	•• 35.6	18 16.9	•• 04.4	211 52.7	•• 53.7	282 50.6	143	•17 17.5	−110
22	72 14.2	102 22.6	58.4	97 34.0	34.8	33 19.4	04.4	226 55.0	53.8	297 23.9	143	17 06.5	−110
23	87 16.7	117 22.3	57.3	112 34.6	34.1	48 21.9	04.4	241 57.3	53.8	311 57.2	144	16 55.5	−111
3 0	102 19.2	132 22.1	−13 56.2	127 35.3	−11 33.4	63 24.3	+14 04.4	256 59.7	− 7 53.8	326 30.6	145	+16 44.4	−112
1	117 21.6	147 21.8	55.1	142 35.9	32.7	78 26.8	04.4	272 02.0	53.9	341 04.1	145	16 33.2	−112
2	132 24.1	162 21.5	54.0	157 36.6	31.9	93 29.3	04.4	287 04.3	53.9	355 37.6	146	16 22.0	−113
3	147 26.6	177 21.3	•• 52.9	172 37.2	•• 31.2	108 31.8	•• 04.4	302 06.6	•• 54.0	10 11.2	147	•16 10.7	−113
4	162 29.0	192 21.0	51.8	187 37.8	30.5	123 34.3	04.4	317 09.0	54.0	24 44.9	147	15 59.4	−114
5	177 31.5	207 20.8	50.7	202 38.5	29.8	138 36.8	04.5	332 11.3	54.0	39 18.6	149	15 48.0	−114
6	192 34.0	222 20.5	−13 49.6	217 39.1	−11 29.0	153 39.3	+14 04.5	347 13.6	− 7 54.1	53 52.5	148	+15 36.6	−115
7	207 36.4	237 20.3	48.5	232 39.8	28.3	168 41.7	04.5	2 15.9	54.1	68 26.3	150	15 25.1	−116
8	222 38.9	252 20.0	47.4	247 40.4	27.6	183 44.2	04.5	17 18.3	54.2	83 00.3	150	15 13.5	−116
9	237 41.4	267 19.8	•• 46.3	262 41.1	•• 26.9	198 46.7	•• 04.5	32 20.6	•• 54.2	97 34.3	150	•15 01.9	−117
10	252 43.8	282 19.5	45.2	277 41.7	26.1	213 49.2	04.5	47 22.9	54.2	112 08.3	152	14 50.2	−117
11	267 46.3	297 19.3	44.1	292 42.3	25.4	228 51.7	04.5	62 25.3	54.3	126 42.5	151	14 38.5	−118
12	282 48.7	312 19.0	−13 42.9	307 43.0	−11 24.7	243 54.2	+14 04.5	77 27.6	− 7 54.3	141 16.6	153	+14 26.7	−119
13	297 51.2	327 18.8	41.8	322 43.6	23.9	258 56.7	04.5	92 29.9	54.4	155 50.9	153	14 14.8	−118
14	312 53.7	342 18.5	40.7	337 44.3	23.2	273 59.1	04.5	107 32.3	54.4	170 25.2	154	14 03.0	−120
15	327 56.1	357 18.3	•• 39.6	352 44.9	•• 22.5	289 01.6	•• 04.5	122 34.6	•• 54.4	184 59.6	154	•13 51.0	−120
16	342 58.6	12 18.0	38.5	7 45.6	21.8	304 04.1	04.5	137 36.9	54.5	199 34.0	155	13 39.0	−120
17	358 01.1	27 17.8	37.4	22 46.2	21.0	319 06.6	04.5	152 39.2	54.5	214 08.5	155	13 27.0	−121
18	13 03.5	42 17.5	−13 36.3	37 46.9	−11 20.3	334 09.1	+14 04.5	167 41.6	− 7 54.6	228 43.0	156	+13 14.9	−121
19	28 06.0	57 17.3	35.2	52 47.5	19.6	349 11.5	04.6	182 43.9	54.6	243 17.6	157	13 02.8	−122
20	43 08.5	72 17.1	34.1	67 48.1	18.8	4 14.0	04.6	197 46.2	54.6	257 52.3	157	12 50.6	−122
21	58 10.9	87 16.8	•• 33.0	82 48.8	•• 18.1	19 16.5	•• 04.6	212 48.6	•• 54.7	272 27.0	157	•12 38.4	−123
22	73 13.4	102 16.6	31.8	97 49.4	17.4	34 19.0	04.6	227 50.9	54.7	287 01.7	158	12 26.1	−123
23	88 15.9	117 16.3	30.7	112 50.1	16.7	49 21.5	04.6	242 53.2	54.8	301 36.5	159	12 13.8	−123
24	103 18.3	132 16.1	−13 29.6	127 50.7	−11 15.9	64 24.0	+14 04.6	257 55.6	− 7 54.8	316 11.4	159	+12 01.5	−124
code	−	− 3	+ 11	+ 6	+ 7	+ 25	0	+ 24	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
1 0	179 09.5	−23 02.9
1	194 09.2	02.7
2	209 08.9	02.5
3	224 08.6 ••	02.3
4	239 08.3	02.1
5	254 08.0	01.9
6	269 07.7	−23 01.7
7	284 07.4	01.5
8	299 07.1	01.3
9	314 06.8 ••	01.1
10	329 06.5	00.9
11	344 06.2	00.7
12	359 05.9	−23 00.5
13	14 05.6	00.3
14	29 05.3	23 00.1
15	44 05.0	−22 59.9
16	59 04.7	59.6
17	74 04.4	59.4
18	89 04.1	−22 59.2
19	104 03.9	59.0
20	119 03.6	58.8
21	134 03.3 ••	58.6
22	149 03.0	58.4
23	164 02.7	58.2
2 0	179 02.4	−22 57.9
1	194 02.1	57.7
2	209 01.8	57.5
3	224 01.5 ••	57.3
4	239 01.2	57.1
5	254 00.9	56.9
6	269 00.6	−22 56.6
7	284 00.3	56.4
8	299 00.1	56.2
9	313 59.8 ••	56.0
10	328 59.5	55.8
11	343 59.2	55.5
12	358 58.9	−22 55.3
13	13 58.6	55.1
14	28 58.3	54.8
15	43 58.0 ••	54.6
16	58 57.7	54.4
17	73 57.4	54.2
18	88 57.1	−22 53.9
19	103 56.9	53.7
20	118 56.6	53.5
21	133 56.3 ••	53.2
22	148 56.0	53.0
23	163 55.7	52.8
3 0	178 55.4	−22 52.5
1	193 55.1	52.3
2	208 54.8	52.1
3	223 54.5 ••	51.8
4	238 54.3	51.6
5	253 54.0	51.4
6	268 53.7	−22 51.1
7	283 53.4	50.9
8	298 53.1	50.6
9	313 52.8 ••	50.4
10	328 52.5	50.2
11	343 52.2	49.9
12	358 52.0	−22 49.7
13	13 51.7	49.4
14	28 51.4	49.2
15	43 51.1 ••	48.9
16	58 50.8	48.7
17	73 50.5	48.4
18	88 50.2	−22 48.2
19	103 49.9	47.9
20	118 49.7	47.7
21	133 49.4 ••	47.4
22	148 49.1	47.2
23	163 48.8	46.9
24	178 48.5	−22 46.7
code	−	+ 2

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.4	−40 29.6
5	Achernar	336 00.1	−57 28.7
30	Acrux	174 00.3	−62 50.1
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.5	+49 32.4
55	Al Na'ir	28 40.8	−47 11.6
15	Alnilam	276 32.1	− 1 13.7
25	Alphard	218 40.4	− 8 27.2
41	Alphecca	126 49.6	+26 52.0
1	Alpheratz	358 30.6	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.3	−42 33.8
42	Antares	113 22.3	−26 19.8
37	Arcturus	146 37.2	+19 25.3
43	Atria	109 05.5	−68 56.6
22	Avior	234 36.2	−59 21.3
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.1
12	Capella	281 41.1	+45 57.3
53	Deneb	50 02.9	+45 06.8
28	Denebola	183 19.7	+14 49.9
4	Diphda	349 41.3	−18 14.7
27	Dubhe	194 46.6	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.8	+51 29.4
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.0	−29 52.4
31	Gacrux	172 51.7	−56 50.8
29	Gienah	176 39.0	−17 16.9
35	Hadar	149 52.8	−60 08.7
6	Hamal	328 51.9	+23 14.7
48	Kaus Aust.	84 44.4	−34 24.6
40	Kochab	137 18.1	+74 20.4
57	Markab	14 23.7	+14 57.2
8	Menkar	315 02.3	+ 3 54.5
36	Menkent	149 01.4	−36 08.3
24	Miapl'dus	221 49.0	−69 31.2
9	Mirfak	309 45.1	+49 42.1
50	Nunki	76 54.9	−26 21.5
52	Peacock	54 31.1	−56 53.4
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.3	−60 38.5
44	Sabik	103 04.9	−15 40.2
3	Schedar	350 32.6	+56 17.2
45	Shaula	97 23.9	−37 04.4
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.2	−10 55.1
23	Suhail	223 25.6	−43 14.4
49	Vega	81 10.1	+38 44.2
39	Zub'g'bi	137 55.9	−15 50.9

GMT	Equation of Time (App.—Mean) 1	2	3
h	m s	m s	m s
0	− 3 21.6	− 3 49.9	− 4 17.8
6	− 3 28.7	− 3 56.9	− 4 24.7
12	− 3 35.8	− 4 03.9	− 4 31.6
18	− 3 42.8	− 4 10.8	− 4 38.5
24	− 3 49.9	− 4 17.8	− 4 45.4

Lat.	Sunrise	Twlt. begins	Moonrise 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	▬	6 54	▭	▭	17 39	19 49
70	▬	6 45	▭	15 42	18 06	20 01
68	▬	6 38	▭	16 26	18 26	20 11
66	10 26	6 33	14 49	16 55	18 41	20 19
64	9 49	6 28	15 30	17 17	18 54	20 26
62	9 22	6 23	15 58	17 34	19 05	20 31
60	9 02	6 18	16 19	17 48	19 14	20 36
58	8 45	6 14	16 36	18 00	19 22	20 40
56	8 31	6 10	16 51	18 11	19 29	20 44
54	8 19	6 06	17 03	18 20	19 35	20 48
52	8 08	6 03	17 14	18 28	19 40	20 51
50	7 59	6 00	17 24	18 35	19 45	20 54
45	7 39	5 52	17 44	18 51	19 56	21 00
40	7 22	5 45	18 01	19 04	20 05	21 05
35	7 08	5 38	18 15	19 15	20 13	21 09
30	6 56	5 31	18 27	19 24	20 19	21 13
20	6 36	5 17	18 47	19 40	20 31	21 20
10	6 17	5 02	19 05	19 54	20 41	21 26
0	6 00	4 45	19 22	20 07	20 50	21 31
10	5 43	4 26	19 38	20 21	21 00	21 36
20	5 25	4 00	19 56	20 35	21 10	21 42
30	5 03	3 26	20 16	20 50	21 21	21 49
35	4 50	3 04	20 28	20 59	21 27	21 52
40	4 36	2 33	20 41	21 10	21 35	21 57
45	4 18	1 47	20 57	21 22	21 43	22 02
50	3 56	////	21 16	21 37	21 53	22 07
52	3 46	////	21 25	21 44	21 58	22 10
54	3 34	////	21 35	21 51	22 03	22 13
56	3 20	////	21 47	22 00	22 09	22 16
58	3 04	////	22 00	22 09	22 15	22 20
60	2 44	////	22 16	22 20	22 23	22 24
S						

Lat.	Sunset	Twlt. ends	Moonset 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	▬	17 14	▭	▭	12 03	11 19
70	▬	17 23	▭	12 28	11 34	11 05
68	▬	17 30	▭	11 43	11 13	10 53
66	13 42	17 36	11 42	11 12	10 56	10 43
64	14 20	17 41	11 00	10 50	10 42	10 35
62	14 46	17 46	10 32	10 31	10 30	10 28
60	15 06	17 50	10 10	10 16	10 20	10 22
58	15 23	17 54	9 52	10 04	10 11	10 16
56	15 37	17 58	9 37	9 52	10 03	10 11
54	15 50	18 02	9 24	9 42	9 56	10 07
52	16 00	18 05	9 12	9 34	9 50	10 03
50	16 10	18 09	9 02	9 26	9 44	9 59
45	16 30	18 16	8 40	9 09	9 32	9 52
40	16 46	18 23	8 23	8 55	9 22	9 45
35	17 00	18 30	8 08	8 43	9 13	9 39
30	17 12	18 37	7 56	8 33	9 05	9 34
20	17 33	18 51	7 34	8 15	8 51	9 25
10	17 51	19 06	7 15	7 59	8 40	9 17
0	18 08	19 23	6 57	7 44	8 28	9 10
10	18 25	19 42	6 39	7 29	8 17	9 03
20	18 43	20 07	6 19	7 13	8 05	8 55
30	19 05	20 41	5 57	6 55	7 51	8 45
35	19 18	21 04	5 43	6 44	7 43	8 40
40	19 32	21 33	5 28	6 31	7 34	8 34
45	19 50	22 19	5 10	6 17	7 23	8 27
50	20 12	////	4 47	5 58	7 09	8 18
52	20 22	////	4 36	5 50	7 03	8 14
54	20 34	////	4 23	5 40	6 56	8 10
56	20 48	////	4 09	5 29	6 48	8 05
58	21 04	////	3 52	5 16	6 40	8 00
60	21 23	////	3 31	5 02	6 29	7 54
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
1	0 45	15 10	15 31	19 51	6 58
2	1 33	15 10	15 30	19 47	6 55
3	2 18	15 11	15 29	19 43	6 51
4	3 00	15 11	15 28	19 39	6 47

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	1	2	3
°	′	′	′
0	12.8	12.4	12.0
4	12.8	12.4	12.0
8	12.8	12.4	12.0
12	12.8	12.4	12.1
16	12.9	12.5	12.1
20	12.9	12.6	12.2
24	13.0	12.6	12.3
28	13.0	12.7	12.4
32	13.1	12.8	12.5
36	13.2	12.9	12.6
40	13.3	13.0	12.7
44	13.4	13.1	12.8
48	13.5	13.3	13.0
52	13.7	13.4	13.1
56	13.8	13.5	13.3
60	13.9	13.7	13.5
64	14.1	13.9	13.6
68	14.2	14.0	13.8
72	14.3	14.2	14.0
76	14.5	14.4	14.2
80	14.6	14.5	14.4
84	14.8	14.7	14.6
88	14.9	14.8	14.7
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	1	2	3
°	′	′	′
0	17.2	17.4	17.6
4	17.1	17.4	17.6
8	17.1	17.3	17.5
12	17.1	17.3	17.5
16	17.0	17.2	17.5
20	17.0	17.2	17.4
24	16.9	17.1	17.3
28	16.9	17.0	17.2
32	16.8	16.9	17.1
36	16.7	16.8	17.0
40	16.6	16.7	16.9
44	16.5	16.6	16.7
48	16.4	16.5	16.6
52	16.2	16.3	16.4
56	16.1	16.2	16.3
60	16.0	16.0	16.1
64	15.8	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.2	15.2
84	15.1	15.0	15.0
88	15.0	14.9	14.8
90			

Subtract from table, back cover

New Year's Day 1

GMT	♈ GHA	VENUS −3.8 GHA	Dec.	MARS 1.2 GHA	Dec.	JUPITER −2.2 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
4 0	103 18.3	132 16.1	−13 29.6	127 50.7	−11 15.9	64 24.0	+14 04.6	257 55.6	− 7 54.8	316 11.4	159	+12 01.5	−124
1	118 20.8	147 15.9	28.5	142 51.4	15.2	79 26.4	04.6	272 57.9	54.8	330 46.3	160	11 49.1	−124
2	133 23.2	162 15.6	27.4	157 52.0	14.5	94 28.9	04.6	288 00.2	54.9	345 21.3	160	11 36.7	−125
3	148 25.7	177 15.4	·· 26.3	172 52.7	·· 13.7	109 31.4	·· 04.6	303 02.6	·· 54.9	359 56.3	160	·11 24.2	−125
4	163 28.2	192 15.1	25.1	187 53.3	13.0	124 33.9	04.6	318 04.9	55.0	14 31.3	161	11 11.7	−126
5	178 30.6	207 14.9	24.0	202 54.0	12.3	139 36.3	04.6	333 07.2	55.0	29 06.4	162	10 59.1	−126
6	193 33.1	222 14.7	−13 22.9	217 54.6	−11 11.6	154 38.8	+14 04.6	348 09.6	− 7 55.0	43 41.6	162	+10 46.5	−126
7	208 35.6	237 14.4	21.8	232 55.3	10.8	169 41.3	04.7	3 11.9	55.1	58 16.8	162	10 33.9	−126
8	223 38.0	252 14.2	20.7	247 55.9	10.1	184 43.8	04.7	18 14.2	55.1	72 52.0	163	10 21.3	−127
9	238 40.5	267 14.0	·· 19.6	262 56.6	·· 09.4	199 46.2	·· 04.7	33 16.6	·· 55.2	87 27.3	163	·10 08.6	−128
10	253 43.0	282 13.7	18.4	277 57.2	08.6	214 48.7	04.7	48 18.9	55.2	102 02.6	163	9 55.8	−127
11	268 45.4	297 13.5	17.3	292 57.8	07.9	229 51.2	04.7	63 21.2	55.2	116 37.9	165	9 43.1	−128
12	283 47.9	312 13.3	−13 16.2	307 58.5	−11 07.2	244 53.7	+14 04.7	78 23.6	− 7 55.3	131 13.4	164	+ 9 30.3	−129
13	298 50.3	327 13.0	15.1	322 59.1	06.4	259 56.2	04.7	93 25.9	55.3	145 48.8	165	9 17.4	−128
14	313 52.8	342 12.8	14.0	337 59.8	05.7	274 58.6	04.7	108 28.2	55.3	160 24.3	165	9 04.6	−129
15	328 55.3	357 12.6	·· 12.8	353 00.4	·· 05.0	290 01.1	·· 04.7	123 30.6	·· 55.4	174 59.8	165	· 8 51.7	−129
16	343 57.7	12 12.4	11.7	8 01.1	04.2	305 03.6	04.7	138 32.9	55.4	189 35.3	166	8 38.8	−130
17	359 00.2	27 12.1	10.6	23 01.7	03.5	320 06.0	04.7	153 35.2	55.5	204 10.9	166	8 25.8	−130
18	14 02.7	42 11.9	−13 09.5	38 02.4	−11 02.8	335 08.5	+14 04.8	168 37.6	− 7 55.5	218 46.5	167	+ 8 12.8	−130
19	29 05.1	57 11.7	08.3	53 03.0	02.0	350 11.0	04.8	183 39.9	55.5	233 22.2	167	7 59.8	−130
20	44 07.6	72 11.5	07.2	68 03.7	01.3	5 13.5	04.8	198 42.2	55.6	247 57.9	167	7 46.8	−131
21	59 10.1	87 11.2	·· 06.1	83 04.3	·11 00.6	20 15.9	·· 04.8	213 44.6	·· 55.6	262 33.6	167	· 7 33.7	−131
22	74 12.5	102 11.0	05.0	98 05.0	10 59.8	35 18.4	04.8	228 46.9	55.7	277 09.3	168	7 20.6	−131
23	89 15.0	117 10.8	03.8	113 05.6	59.1	50 20.9	04.8	243 49.2	55.7	291 45.1	168	7 07.5	−131
5 0	104 17.5	132 10.6	−13 02.7	128 06.3	−10 58.4	65 23.4	+14 04.8	258 51.6	− 7 55.7	306 20.9	168	+ 6 54.4	−132
1	119 19.9	147 10.3	01.6	143 06.9	57.6	80 25.8	04.8	273 53.9	55.8	320 56.7	169	6 41.2	−132
2	134 22.4	162 10.1	13 00.5	158 07.6	56.9	95 28.3	04.8	288 56.2	55.8	335 32.6	169	6 28.0	−132
3	149 24.8	177 09.9	·12 59.3	173 08.2	·· 56.2	110 30.8	·· 04.9	303 58.6	·· 55.8	350 08.5	169	· 6 14.8	−132
4	164 27.3	192 09.7	58.2	188 08.9	55.4	125 33.2	04.9	319 00.9	55.9	4 44.4	169	6 01.6	−132
5	179 29.8	207 09.5	57.1	203 09.5	54.7	140 35.7	04.9	334 03.2	55.9	19 20.3	169	5 48.4	−133
6	194 32.2	222 09.3	−12 55.9	218 10.2	−10 54.0	155 38.2	+14 04.9	349 05.6	− 7 56.0	33 56.2	170	+ 5 35.1	−133
7	209 34.7	237 09.0	54.8	233 10.8	53.2	170 40.6	04.9	4 07.9	56.0	48 32.2	170	5 21.8	−133
8	224 37.2	252 08.8	53.7	248 11.5	52.5	185 43.1	04.9	19 10.3	56.0	63 08.2	170	5 08.5	−133
9	239 39.6	267 08.6	·· 52.5	263 12.1	·· 51.8	200 45.6	·· 04.9	34 12.6	·· 56.1	77 44.2	170	· 4 55.2	−134
10	254 42.1	282 08.4	51.4	278 12.8	51.0	215 48.0	04.9	49 14.9	56.1	92 20.2	171	4 41.8	−133
11	269 44.6	297 08.2	50.3	293 13.4	50.3	230 50.5	04.9	64 17.3	56.1	106 56.3	170	4 28.5	−134
12	284 47.0	312 08.0	−12 49.1	308 14.1	−10 49.6	245 53.0	+14 05.0	79 19.6	− 7 56.2	121 32.3	171	+ 4 15.1	−134
13	299 49.5	327 07.8	48.0	323 14.7	48.8	260 55.4	05.0	94 21.9	56.2	136 08.4	171	4 01.7	−134
14	314 52.0	342 07.5	46.9	338 15.4	48.1	275 57.9	05.0	109 24.3	56.3	150 44.5	171	3 48.3	−135
15	329 54.4	357 07.3	·· 45.7	353 16.1	·· 47.4	291 00.4	·· 05.0	124 26.6	·· 56.3	165 20.6	171	· 3 34.8	−134
16	344 56.9	12 07.1	44.6	8 16.7	46.6	306 02.8	05.0	139 28.9	56.3	179 56.7	171	3 21.4	−134
17	359 59.3	27 06.9	43.5	23 17.4	45.9	321 05.3	05.0	154 31.3	56.4	194 32.8	171	3 08.0	−135
18	15 01.8	42 06.7	−12 42.3	38 18.0	−10 45.1	336 07.8	+14 05.0	169 33.6	− 7 56.4	209 08.9	171	+ 2 54.5	−135
19	30 04.3	57 06.5	41.2	53 18.7	44.4	351 10.2	05.1	184 36.0	56.4	223 45.0	172	2 41.0	−135
20	45 06.7	72 06.3	40.1	68 19.3	43.7	6 12.7	05.1	199 38.3	56.5	238 21.2	171	2 27.5	−135
21	60 09.2	87 06.1	·· 38.9	83 20.0	·· 42.9	21 15.2	·· 05.1	214 40.6	·· 56.5	252 57.3	172	· 2 14.0	−135
22	75 11.7	102 05.9	37.8	98 20.6	42.2	36 17.6	05.1	229 43.0	56.6	267 33.5	171	2 00.5	−135
23	90 14.1	117 05.7	36.7	113 21.3	41.5	51 20.1	05.1	244 45.3	56.6	282 09.6	172	1 47.0	−135
6 0	105 16.6	132 05.5	−12 35.5	128 21.9	−10 40.7	66 22.5	+14 05.1	259 47.7	− 7 56.6	296 45.8	171	+ 1 33.5	−135
1	120 19.1	147 05.3	34.4	143 22.6	40.0	81 25.0	05.1	274 50.0	56.7	311 21.9	172	1 20.0	−136
2	135 21.5	162 05.1	33.2	158 23.2	39.3	96 27.5	05.1	289 52.3	56.7	325 58.1	171	1 06.4	−135
3	150 24.0	177 04.9	·· 32.1	173 23.9	·· 38.5	111 29.9	·· 05.2	304 54.7	·· 56.7	340 34.2	172	· 0 52.9	−136
4	165 26.5	192 04.7	31.0	188 24.5	37.8	126 32.4	05.2	319 57.0	56.8	355 10.4	171	0 39.3	−135
5	180 28.9	207 04.5	29.8	203 25.2	37.0	141 34.9	05.2	334 59.4	56.8	9 46.5	172	0 25.8	−136
6	195 31.4	222 04.3	−12 28.7	218 25.9	−10 36.3	156 37.3	+14 05.2	350 01.7	− 7 56.8	24 22.7	171	+ 0 12.2	−136
7	210 33.8	237 04.1	27.5	233 26.5	35.6	171 39.8	05.2	5 04.0	56.9	38 58.8	171	− 0 01.4	−135
8	225 36.3	252 03.9	26.4	248 27.2	34.8	186 42.2	05.2	20 06.4	56.9	53 34.9	172	0 14.9	−136
9	240 38.8	267 03.7	·· 25.3	263 27.8	·· 34.1	201 44.7	·· 05.2	35 08.7	·· 57.0	68 11.1	171	· 0 28.5	−136
10	255 41.2	282 03.5	24.1	278 28.5	33.4	216 47.2	05.3	50 11.1	57.0	82 47.2	171	0 42.1	−135
11	270 43.7	297 03.3	23.0	293 29.1	32.6	231 49.6	05.3	65 13.4	57.0	97 23.3	171	0 55.6	−136
12	285 46.2	312 03.1	−12 21.8	308 29.8	−10 31.9	246 52.1	+14 05.3	80 15.7	− 7 57.1	111 59.4	171	− 1 09.2	−136
13	300 48.6	327 02.9	20.7	323 30.4	31.1	261 54.5	05.3	95 18.1	57.1	126 35.5	170	1 22.8	−136
14	315 51.1	342 02.7	19.5	338 31.1	30.4	276 57.0	05.3	110 20.4	57.1	141 11.5	171	1 36.4	−135
15	330 53.6	357 02.5	·· 18.4	353 31.7	·· 29.7	291 59.4	·· 05.3	125 22.8	·· 57.2	155 47.6	170	· 1 49.9	−136
16	345 56.0	12 02.3	17.2	8 32.4	28.9	307 01.9	05.4	140 25.1	57.2	170 23.6	170	2 03.5	−136
17	0 58.5	27 02.1	16.1	23 33.1	28.2	322 04.4	05.4	155 27.4	57.2	184 59.6	170	2 17.1	−136
18	16 00.9	42 01.9	−12 15.0	38 33.7	−10 27.4	337 06.8	+14 05.4	170 29.8	− 7 57.3	199 35.6	170	− 2 30.7	−135
19	31 03.4	57 01.8	13.8	53 34.4	26.7	352 09.3	05.4	185 32.1	57.3	214 11.6	170	2 44.2	−136
20	46 05.9	72 01.6	12.7	68 35.0	26.0	7 11.7	05.4	200 34.5	57.3	228 47.6	169	2 57.8	−135
21	61 08.3	87 01.4	·· 11.5	83 35.7	·· 25.2	22 14.2	·· 05.4	215 36.8	·· 57.4	243 23.5	169	· 3 11.3	−136
22	76 10.8	102 01.2	10.4	98 36.3	24.5	37 16.6	05.4	230 39.1	57.4	257 59.4	169	3 24.9	−135
23	91 13.3	117 01.0	09.2	113 37.0	23.7	52 19.1	05.5	245 41.5	57.5	272 35.3	169	3 38.4	−136
0 24	106 15.7	132 00.8	−12 08.1	128 37.7	−10 23.0	67 21.5	+14 05.5	260 43.8	− 7 57.5	287 11.2	169	− 3 52.0	−135
code	−	− 2	+ 11	+ 6	+ 8	+ 24	0	+ 23	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
4 0	178 48.5	−22 46.7
1	193 48.2	46.4
2	208 47.9	46.2
3	223 47.7 ••	45.9
4	238 47.4	45.7
5	253 47.1	45.4
6	268 46.8	−22 45.1
7	283 46.5	44.9
8	298 46.2	44.6
9	313 46.0 ••	44.4
10	328 45.7	44.1
11	343 45.4	43.8
12	358 45.1	−22 43.6
13	13 44.8	43.3
14	28 44.5	43.1
15	43 44.3 ••	42.8
16	58 44.0	42.5
17	73 43.7	42.3
18	88 43.4	−22 42.0
19	103 43.1	41.7
20	118 42.8	41.5
21	133 42.6 ••	41.2
22	148 42.3	40.9
23	163 42.0	40.6
5 0	178 41.7	−22 40.4
1	193 41.4	40.1
2	208 41.2	39.8
3	223 40.9 ••	39.5
4	238 40.6	39.3
5	253 40.3	39.0
6	268 40.0	−22 38.7
7	283 39.8	38.4
8	298 39.5	38.2
9	313 39.2 ••	37.9
10	328 38.9	37.6
11	343 38.6	37.3
12	358 38.4	−22 37.0
13	13 38.1	36.8
14	28 37.8	36.5
15	43 37.5 ••	36.2
16	58 37.2	35.9
17	73 37.0	35.6
18	88 36.7	−22 35.3
19	103 36.4	35.0
20	118 36.1	34.8
21	133 35.9 ••	34.5
22	148 35.6	34.2
23	163 35.3	33.9
6 0	178 35.0	−22 33.6
1	193 34.8	33.3
2	208 34.5	33.0
3	223 34.2 ••	32.7
4	238 33.9	32.4
5	253 33.6	32.1
6	268 33.4	−22 31.8
7	283 33.1	31.5
8	298 32.8	31.3
9	313 32.5 ••	31.0
10	328 32.3	30.7
11	343 32.0	30.4
12	358 31.7	−22 30.1
13	13 31.4	29.8
14	28 31.2	29.5
15	43 30.9 ••	29.2
16	58 30.6	28.8
17	73 30.4	28.5
18	88 30.1	−22 28.2
19	103 29.8	27.9
20	118 29.5	27.6
21	133 29.3 ••	27.3
22	148 29.0	27.0
23	163 28.7	26.7
24	178 28.4	−22 26.4
code	−	+ 2

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.4	−40 29.6
5	Achernar	336 00.1	−57 28.7
30	Acrux	174 00.3	−62 50.2
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.5	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.6	+26 52.0
1	Alpheratz	358 30.6	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.3	−42 33.8
42	Antares	113 22.3	−26 19.8
37	Arcturus	146 37.2	+19 25.3
43	Atria	109 05.4	−68 56.6
22	Avior	234 36.1	−59 21.3
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.1
12	Capella	281 41.1	+45 57.3
53	Deneb	50 02.9	+45 06.8
28	Denebola	183 19.7	+14 49.9
4	Diphda	349 41.3	−18 14.7
27	Dubhe	194 46.6	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.7	+51 29.4
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.7	−56 50.8
29	Gienah	176 39.0	−17 16.9
35	Hadar	149 52.7	−60 08.7
6	Hamal	328 51.9	+23 14.7
48	Kaus Aust.	84 44.3	−34 24.6
40	Kochab	137 18.1	+74 20.4
57	Markab	14 23.7	+14 57.2
8	Menkar	315 02.3	+ 3 54.5
36	Menkent	149 01.3	−36 08.3
24	Miapl'dus	221 48.9	−69 31.2
9	Mirfak	309 45.1	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.4
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.3	−60 38.5
44	Sabik	103 04.9	−15 40.2
3	Schedar	350 32.6	+56 17.2
45	Shaula	97 23.9	−37 04.4
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.1	−10 55.1
23	Suhail	223 25.6	−43 14.4
49	Vega	81 10.1	+38 44.2
39	Zub'g'bi	137 55.9	−15 50.9

GMT	Equation of Time (App.—Mean) 4	5	6
h	m s	m s	m s
0	− 4 45.4	− 5 12.6	− 5 39.3
6	− 4 52.2	− 5 19.3	− 5 46.0
12	− 4 59.0	− 5 26.0	− 5 52.6
18	− 5 05.8	− 5 32.7	− 5 59.1
24	− 5 12.6	− 5 39.3	− 6 05.7

Lat.	Sunrise	Twlt. begins	Moonrise 4	5	6	7
N °	h m	h m	h m	h m	h m	h m
72	▬	6 51	19 49	21 45	23 39	25 40
70	▬	6 44	20 01	21 48	23 33	25 24
68	11 31	6 37	20 11	21 50	23 29	25 11
66	10 20	6 32	20 19	21 52	23 25	25 01
64	9 45	6 26	20 26	21 54	23 22	24 52
62	9 20	6 22	20 31	21 55	23 19	24 45
60	9 00	6 18	20 36	21 56	23 17	24 39
58	8 44	6 13	20 40	21 58	23 15	24 33
56	8 30	6 10	20 44	21 59	23 13	24 28
54	8 18	6 06	20 48	21 59	23 11	24 24
52	8 08	6 03	20 51	22 00	23 09	24 20
50	7 58	6 00	20 54	22 01	23 08	24 17
45	7 38	5 52	21 00	22 02	23 05	24 09
40	7 22	5 45	21 05	22 04	23 02	24 02
35	7 09	5 39	21 09	22 05	23 00	23 57
30	6 57	5 32	21 13	22 06	22 58	23 52
20	6 36	5 18	21 20	22 08	22 55	23 44
10	6 19	5 03	21 26	22 09	22 52	23 37
0	6 02	4 46	21 31	22 10	22 50	23 30
10	5 45	4 27	21 36	22 12	22 47	23 24
20	5 27	4 03	21 42	22 13	22 44	23 16
30	5 05	3 30	21 49	22 15	22 41	23 09
35	4 53	3 07	21 52	22 16	22 40	23 04
40	4 38	2 37	21 57	22 17	22 38	22 59
45	4 21	1 52	22 02	22 19	22 35	22 53
50	4 00	////	22 07	22 20	22 33	22 46
52	3 49	////	22 10	22 21	22 31	22 43
54	3 38	////	22 13	22 22	22 30	22 39
56	3 24	////	22 16	22 23	22 29	22 35
58	3 09	////	22 20	22 23	22 27	22 31
60	2 50	////	22 24	22 25	22 25	22 26
S						

Lat.	Sunset	Twlt. ends	Moonset 4	5	6	7
N °	h m	h m	h m	h m	h m	h m
72	▬	17 19	11 19	10 47	10 19	9 49
70	▬	17 27	11 05	10 41	10 20	9 58
68	12 40	17 34	10 53	10 36	10 21	10 05
66	13 51	17 40	10 43	10 32	10 21	10 11
64	14 26	17 45	10 35	10 28	10 22	10 16
62	14 52	17 50	10 28	10 25	10 23	10 20
60	15 11	17 54	10 22	10 23	10 23	10 24
58	15 28	17 58	10 16	10 20	10 24	10 27
56	15 41	18 01	10 11	10 18	10 24	10 30
54	15 53	18 05	10 07	10 16	10 24	10 33
52	16 04	18 08	10 03	10 14	10 25	10 36
50	16 13	18 11	9 59	10 13	10 25	10 38
45	16 33	18 19	9 52	10 09	10 26	10 43
40	16 49	18 26	9 45	10 06	10 26	10 47
35	17 02	18 32	9 39	10 03	10 27	10 51
30	17 14	18 39	9 34	10 01	10 27	10 54
20	17 35	18 53	9 25	9 57	10 28	10 59
10	17 52	19 07	9 17	9 53	10 29	11 04
0	18 09	19 24	9 10	9 50	10 29	11 09
10	18 26	19 43	9 03	9 47	10 30	11 14
20	18 44	20 07	8 55	9 43	10 30	11 19
30	19 05	20 40	8 45	9 39	10 31	11 24
35	19 18	21 03	8 40	9 36	10 32	11 28
40	19 32	21 32	8 34	9 33	10 32	11 31
45	19 49	22 16	8 27	9 30	10 33	11 36
50	20 11	////	8 18	9 26	10 33	11 41
52	20 21	////	8 14	9 24	10 33	11 43
54	20 33	////	8 10	9 22	10 34	11 46
56	20 46	////	8 05	9 20	10 34	11 49
58	21 02	////	8 00	9 18	10 34	11 52
60	21 20	////	7 54	9 15	10 35	11 56
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
4	3 00	15 11	15 28	19 39	6 47
5	3 41	15 12	15 27	19 35	6 44
6	4 20	15 12	15 26	19 31	6 40
7	4 59	15 12	15 25	19 27	6 36

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	4	5	6
°	′	′	′
0	11.9	11.9	12.1
4	11.9	11.9	12.1
8	11.9	11.9	12.2
12	11.9	11.9	12.2
16	12.0	12.0	12.2
20	12.1	12.1	12.3
24	12.2	12.2	12.4
28	12.2	12.2	12.5
32	12.4	12.4	12.6
36	12.5	12.5	12.7
40	12.6	12.6	12.8
44	12.7	12.7	12.9
48	12.9	12.9	13.1
52	13.1	13.1	13.2
56	13.2	13.2	13.4
60	13.4	13.4	13.5
64	13.6	13.6	13.7
68	13.8	13.8	13.9
72	14.0	14.0	14.1
76	14.2	14.2	14.3
80	14.4	14.4	14.4
84	14.6	14.6	14.6
88	14.7	14.7	14.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	4	5	6
°	′	′	′
0	17.7	17.7	17.5
4	17.6	17.6	17.5
8	17.6	17.6	17.5
12	17.6	17.6	17.4
16	17.5	17.5	17.4
20	17.5	17.5	17.3
24	17.4	17.4	17.2
28	17.3	17.3	17.2
32	17.2	17.2	17.1
36	17.0	17.0	16.9
40	16.9	16.9	16.8
44	16.8	16.8	16.7
48	16.6	16.6	16.6
52	16.5	16.5	16.4
56	16.3	16.3	16.2
60	16.1	16.1	16.1
64	15.9	15.9	15.9
68	15.8	15.8	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.0
88	14.8	14.8	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.8 GHA	VENUS −3.8 Dec.	MARS 1.2 GHA	MARS 1.2 Dec.	JUPITER −2.2 GHA	JUPITER −2.2 Dec.	SATURN 0.9 GHA	SATURN 0.9 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
7 0	106 15.7	132 00.8	−12 08.1	128 37.7	−10 23.0	67 21.5	+14 05.5	260 43.8	− 7 57.5	287 11.2	169	− 3 52.0	−135
1	121 18.2	147 00.6	06.9	143 38.3	22.3	82 24.0	05.5	275 46.2	57.5	301 47.1	168	4 05.5	−135
2	136 20.7	162 00.4	05.8	158 39.0	21.5	97 26.4	05.5	290 48.5	57.6	316 22.9	168	4 19.0	−135
3	151 23.1	177 00.3	•• 04.6	173 39.6	•• 20.8	112 28.9	•• 05.5	305 50.9	•• 57.6	330 58.7	167	• 4 32.5	−135
4	166 25.6	192 00.1	03.5	188 40.3	20.0	127 31.4	05.5	320 53.2	57.6	345 34.4	167	4 46.0	−135
5	181 28.1	206 59.9	02.3	203 40.9	19.3	142 33.8	05.6	335 55.5	57.7	0 10.1	167	4 59.5	−135
6	196 30.5	221 59.7	−12 01.2	218 41.6	−10 18.5	157 36.3	+14 05.6	350 57.9	− 7 57.7	14 45.8	167	− 5 13.0	−135
7	211 33.0	236 59.5	12 00.0	233 42.3	17.8	172 38.7	05.6	6 00.2	57.7	29 21.5	166	5 26.5	−134
8	226 35.4	251 59.4	11 58.9	248 42.9	17.1	187 41.2	05.6	21 02.6	57.8	43 57.1	166	5 39.9	−135
9	241 37.9	266 59.2	•• 57.7	263 43.6	•• 16.3	202 43.6	•• 05.6	36 04.9	•• 57.8	58 32.7	166	• 5 53.4	−134
10	256 40.4	281 59.0	56.5	278 44.2	15.6	217 46.1	05.7	51 07.3	57.8	73 08.3	165	6 06.8	−134
11	271 42.8	296 58.8	55.4	293 44.9	14.8	232 48.5	05.7	66 09.6	57.9	87 43.8	165	6 20.2	−134
12	286 45.3	311 58.6	−11 54.2	308 45.6	−10 14.1	247 51.0	+14 05.7	81 11.9	− 7 57.9	102 19.3	164	− 6 33.6	−134
13	301 47.8	326 58.5	53.1	323 46.2	13.4	262 53.4	05.7	96 14.3	57.9	116 54.7	164	6 47.0	−133
14	316 50.2	341 58.3	51.9	338 46.9	12.6	277 55.9	05.7	111 16.6	58.0	131 30.1	164	7 00.3	−134
15	331 52.7	356 58.1	•• 50.8	353 47.5	•• 11.9	292 58.3	•• 05.7	126 19.0	•• 58.0	146 05.5	163	• 7 13.7	−133
16	346 55.2	11 57.9	49.6	8 48.2	11.1	308 00.8	05.8	141 21.3	58.0	160 40.8	162	7 27.0	−133
17	1 57.6	26 57.8	48.5	23 48.9	10.4	323 03.2	05.8	156 23.7	58.1	175 16.0	163	7 40.3	−133
18	17 00.1	41 57.6	−11 47.3	38 49.5	−10 09.6	338 05.7	+14 05.8	171 26.0	− 7 58.1	189 51.3	161	− 7 53.6	−133
19	32 02.5	56 57.4	46.1	53 50.2	08.9	353 08.1	05.8	186 28.4	58.1	204 26.4	162	8 06.9	−132
20	47 05.0	71 57.3	45.0	68 50.8	08.1	8 10.5	05.8	201 30.7	58.2	219 01.6	160	8 20.1	−133
21	62 07.5	86 57.1	•• 43.8	83 51.5	•• 07.4	23 13.0	•• 05.8	216 33.1	•• 58.2	233 36.6	161	• 8 33.4	−132
22	77 09.9	101 56.9	42.7	98 52.2	06.7	38 15.4	05.9	231 35.4	58.2	248 11.7	159	8 46.6	−131
23	92 12.4	116 56.8	41.5	113 52.8	05.9	53 17.9	05.9	246 37.7	58.3	262 46.6	159	8 59.7	−132
8 0	107 14.9	131 56.6	−11 40.3	128 53.5	−10 05.2	68 20.3	+14 05.9	261 40.1	− 7 58.3	277 21.5	159	− 9 12.9	−131
1	122 17.3	146 56.4	39.2	143 54.1	04.4	83 22.8	05.9	276 42.4	58.3	291 56.4	158	9 26.0	−131
2	137 19.8	161 56.2	38.0	158 54.8	03.7	98 25.2	05.9	291 44.8	58.4	306 31.2	158	9 39.1	−131
3	152 22.3	176 56.1	•• 36.9	173 55.5	•• 02.9	113 27.7	•• 06.0	306 47.1	•• 58.4	321 06.0	157	• 9 52.2	−131
4	167 24.7	191 55.9	35.7	188 56.1	02.2	128 30.1	06.0	321 49.5	58.4	335 40.7	156	10 05.3	−130
5	182 27.2	206 55.8	34.5	203 56.8	01.4	143 32.6	06.0	336 51.8	58.5	350 15.3	156	10 18.3	−130
6	197 29.7	221 55.6	−11 33.4	218 57.4	−10 00.7	158 35.0	+14 06.0	351 54.2	− 7 58.5	4 49.9	155	−10 31.3	−129
7	212 32.1	236 55.4	32.2	233 58.1	10 00.0	173 37.4	06.0	6 56.5	58.5	19 24.4	154	10 44.2	−130
8	227 34.6	251 55.3	31.1	248 58.8	9 59.2	188 39.9	06.1	21 58.9	58.6	33 58.8	154	10 57.2	−129
9	242 37.0	266 55.1	•• 29.9	263 59.4	•• 58.5	203 42.3	•• 06.1	37 01.2	•• 58.6	48 33.2	153	•11 10.1	−128
10	257 39.5	281 54.9	28.7	279 00.1	57.7	218 44.8	06.1	52 03.6	58.6	63 07.5	153	11 22.9	−129
11	272 42.0	296 54.8	27.6	294 00.7	57.0	233 47.2	06.1	67 05.9	58.7	77 41.8	151	11 35.8	−128
12	287 44.4	311 54.6	−11 26.4	309 01.4	− 9 56.2	248 49.7	+14 06.1	82 08.3	− 7 58.7	92 15.9	152	−11 48.6	−127
13	302 46.9	326 54.5	25.2	324 02.1	55.5	263 52.1	06.2	97 10.6	58.7	106 50.1	150	12 01.3	−127
14	317 49.4	341 54.3	24.1	339 02.7	54.7	278 54.5	06.2	112 13.0	58.8	121 24.1	150	12 14.0	−127
15	332 51.8	356 54.2	•• 22.9	354 03.4	•• 54.0	293 57.0	•• 06.2	127 15.3	•• 58.8	135 58.1	149	•12 26.7	−127
16	347 54.3	11 54.0	21.7	9 04.1	53.2	308 59.4	06.2	142 17.7	58.8	150 32.0	148	12 39.4	−126
17	2 56.8	26 53.8	20.6	24 04.7	52.5	324 01.9	06.2	157 20.0	58.9	165 05.8	148	12 52.0	−126
18	17 59.2	41 53.7	−11 19.4	39 05.4	− 9 51.8	339 04.3	+14 06.3	172 22.4	− 7 58.9	179 39.6	146	−13 04.6	−125
19	33 01.7	56 53.5	18.2	54 06.1	51.0	354 06.7	06.3	187 24.7	58.9	194 13.2	146	13 17.1	−125
20	48 04.2	71 53.4	17.1	69 06.7	50.3	9 09.2	06.3	202 27.0	59.0	208 46.8	146	13 29.6	−124
21	63 06.6	86 53.2	•• 15.9	84 07.4	•• 49.5	24 11.6	•• 06.3	217 29.4	•• 59.0	223 20.4	144	•13 42.0	−124
22	78 09.1	101 53.1	14.7	99 08.0	48.8	39 14.0	06.4	232 31.7	59.0	237 53.8	144	13 54.4	−124
23	93 11.5	116 52.9	13.6	114 08.7	48.0	54 16.5	06.4	247 34.1	59.1	252 27.2	142	14 06.8	−123
9 0	108 14.0	131 52.8	−11 12.4	129 09.4	− 9 47.3	69 18.9	+14 06.4	262 36.4	− 7 59.1	267 00.4	142	−14 19.1	−122
1	123 16.5	146 52.6	11.2	144 10.0	46.5	84 21.4	06.4	277 38.8	59.1	281 33.6	142	14 31.3	−123
2	138 18.9	161 52.5	10.0	159 10.7	45.8	99 23.8	06.4	292 41.1	59.2	296 06.8	140	14 43.6	−121
3	153 21.4	176 52.3	•• 08.9	174 11.4	•• 45.0	114 26.2	•• 06.5	307 43.5	•• 59.2	310 39.8	139	•14 55.7	−121
4	168 23.9	191 52.2	07.7	189 12.0	44.3	129 28.7	06.5	322 45.8	59.2	325 12.7	139	15 07.8	−121
5	183 26.3	206 52.0	06.5	204 12.7	43.5	144 31.1	06.5	337 48.2	59.3	339 45.6	137	15 19.9	−120
6	198 28.8	221 51.9	−11 05.4	219 13.4	− 9 42.8	159 33.5	+14 06.5	352 50.6	− 7 59.3	354 18.3	137	−15 31.9	−120
7	213 31.3	236 51.7	04.2	234 14.0	42.0	174 36.0	06.6	7 52.9	59.3	8 51.0	136	15 43.9	−119
8	228 33.7	251 51.6	03.0	249 14.7	41.3	189 38.4	06.6	22 55.3	59.4	23 23.6	135	15 55.8	−118
9	243 36.2	266 51.5	•• 01.8	264 15.4	•• 40.5	204 40.8	•• 06.6	37 57.6	•• 59.4	37 56.1	134	•16 07.6	−118
10	258 38.7	281 51.3	11 00.7	279 16.0	39.8	219 43.3	06.6	53 00.0	59.4	52 28.5	133	16 19.4	−117
11	273 41.1	296 51.2	10 59.5	294 16.7	39.0	234 45.7	06.6	68 02.3	59.4	67 00.8	132	16 31.1	−117
12	288 43.6	311 51.0	−10 58.3	309 17.4	− 9 38.3	249 48.1	+14 06.7	83 04.7	− 7 59.5	81 33.0	131	−16 42.8	−116
13	303 46.0	326 50.9	57.1	324 18.0	37.5	264 50.6	06.7	98 07.0	59.5	96 05.1	131	16 54.4	−116
14	318 48.5	341 50.8	56.0	339 18.7	36.8	279 53.0	06.7	113 09.4	59.5	110 37.2	129	17 06.0	−114
15	333 51.0	356 50.6	•• 54.8	354 19.4	•• 36.0	294 55.4	•• 06.7	128 11.7	•• 59.6	125 09.1	128	•17 17.4	−115
16	348 53.4	11 50.5	53.6	9 20.0	35.3	309 57.9	06.8	143 14.1	59.6	139 40.9	127	17 28.9	−113
17	3 55.9	26 50.3	52.4	24 20.7	34.5	325 00.3	06.8	158 16.4	59.6	154 12.6	127	17 40.2	−113
18	18 58.4	41 50.2	−10 51.3	39 21.4	− 9 33.8	340 02.7	+14 06.8	173 18.8	− 7 59.7	168 44.3	125	−17 51.5	−112
19	34 00.8	56 50.1	50.1	54 22.0	33.0	355 05.2	06.8	188 21.1	59.7	183 15.8	124	18 02.7	−112
20	49 03.3	71 49.9	48.9	69 22.7	32.3	10 07.6	06.9	203 23.5	59.7	197 47.2	123	18 13.9	−111
21	64 05.8	86 49.8	•• 47.7	84 23.4	•• 31.5	25 10.0	•• 06.9	218 25.8	•• 59.8	212 18.5	122	•18 25.0	−110
22	79 08.2	101 49.7	46.6	99 24.0	30.8	40 12.4	06.9	233 28.2	59.8	226 49.7	121	18 36.0	−109
23	94 10.7	116 49.5	45.4	114 24.7	30.0	55 14.9	06.9	248 30.5	59.8	241 20.8	120	18 46.9	−109
24	109 13.2	131 49.4	−10 44.2	129 25.4	− 9 29.3	70 17.3	+14 06.9	263 32.9	− 7 59.8	255 51.8	119	−18 57.8	−108
code	—	− 1	+ 12	+ 7	+ 7	+ 24	+ 1	+ 23	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
7 0	178 28.4	−22 26.4
1	193 28.2	26.1
2	208 27.9	25.8
3	223 27.6 ••	25.5
4	238 27.4	25.2
5	253 27.1	24.8
6	268 26.8	−22 24.5
7	283 26.5	24.2
8	298 26.3	23.9
9	313 26.0 ••	23.6
10	328 25.7	23.3
11	343 25.5	22.9
12	358 25.2	−22 22.6
13	13 24.9	22.3
14	28 24.7	22.0
15	43 24.4 ••	21.7
16	58 24.1	21.3
17	73 23.9	21.0
18	88 23.6	−22 20.7
19	103 23.3	20.4
20	118 23.0	20.1
21	133 22.8 ••	19.7
22	148 22.5	19.4
23	163 22.2	19.1
8 0	178 22.0	−22 18.7
1	193 21.7	18.4
2	208 21.4	18.1
3	223 21.2 ••	17.8
4	238 20.9	17.4
5	253 20.6	17.1
6	268 20.4	−22 16.8
7	283 20.1	16.4
8	298 19.8	16.1
9	313 19.6 ••	15.8
10	328 19.3	15.4
11	343 19.1	15.1
12	358 18.8	−22 14.8
13	13 18.5	14.4
14	28 18.3	14.1
15	43 18.0 ••	13.7
16	58 17.7	13.4
17	73 17.5	13.1
18	88 17.2	−22 12.7
19	103 16.9	12.4
20	118 16.7	12.0
21	133 16.4 ••	11.7
22	148 16.2	11.3
23	163 15.9	11.0
9 0	178 15.6	−22 10.7
1	193 15.4	10.3
2	208 15.1	10.0
3	223 14.9 ••	09.6
4	238 14.6	09.3
5	253 14.3	08.9
6	268 14.1	−22 08.6
7	283 13.8	08.2
8	298 13.5	07.9
9	313 13.3 ••	07.5
10	328 13.0	07.2
11	343 12.8	06.8
12	358 12.5	−22 06.4
13	13 12.2	06.1
14	28 12.0	05.7
15	43 11.7 ••	05.4
16	58 11.5	05.0
17	73 11.2	04.7
18	88 11.0	−22 04.3
19	103 10.7	03.9
20	118 10.4	03.6
21	133 10.2 ••	03.2
22	148 09.9	02.9
23	163 09.7	02.5
24	178 09.4	−22 02.1
code	−	+ 4

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.4	−40 29.6
5	Achernar	336 00.1	−57 28.7
30	Acrux	174 00.2	−62 50.2
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.1	+56 12.5
34	Alkaid	153 34.5	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.6	+26 52.0
1	Alpheratz	358 30.7	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.3	−42 33.8
42	Antares	113 22.2	−26 19.8
37	Arcturus	146 37.1	+19 25.3
43	Atria	109 05.4	−68 56.6
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 20.3	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.1
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.7	+14 49.9
4	Diphda	349 41.3	−18 14.7
27	Dubhe	194 46.5	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.7	+51 29.4
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.6	−56 50.9
29	Gienah	176 39.0	−17 16.9
35	Hadar	149 52.7	−60 08.7
6	Hamal	328 51.9	+23 14.7
48	Kaus Aust.	84 44.3	−34 24.6
57	Kochab	14 23.7	+14 57.2
40	Markab	137 18.0	+74 20.4
8	Menkar	315 02.3	+ 3 54.5
36	Menkent	149 01.3	−36 08.3
24	Miapl'dus	221 48.9	−69 31.3
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.4
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.2	−60 38.5
44	Sabik	103 04.9	−15 40.2
3	Schedar	350 32.6	+56 17.2
45	Shaula	97 23.9	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.1	−10 55.1
23	Suhail	223 25.5	−43 14.4
49	Vega	81 10.1	+38 44.2
39	Zub'g'bi	137 55.8	−15 51.0

GMT	Equation of Time (App.—Mean) 7	8	9
h	m s	m s	m s
0	− 6 05.7	− 6 31.6	− 6 56.9
6	− 6 12.2	− 6 37.9	− 7 03.2
12	− 6 18.7	− 6 44.3	− 7 09.4
18	− 6 25.1	− 6 50.6	− 7 15.7
24	− 6 31.6	− 6 56.9	− 7 21.8

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 7 h m	8 h m	9 h m	10 h m
72	▬	6 48	25 40	1 40	4 08	▬
70	▬	6 41	25 24	1 24	3 30	▬
68	11 10	6 36	25 11	1 11	3 04	5 25
66	10 13	6 30	25 01	1 01	2 45	4 44
64	9 40	6 25	24 52	0 52	2 29	4 16
62	9 16	6 21	24 45	0 45	2 16	3 55
60	8 57	6 16	24 39	0 39	2 05	3 37
58	8 41	6 13	24 33	0 33	1 56	3 23
56	8 28	6 09	24 28	0 28	1 48	3 11
54	8 16	6 06	24 24	0 24	1 40	3 00
52	8 06	6 03	24 20	0 20	1 34	2 51
50	7 57	6 00	24 17	0 17	1 28	2 42
45	7 38	5 52	24 09	0 09	1 15	2 24
40	7 22	5 45	24 02	0 02	1 05	2 10
35	7 09	5 39	23 57	24 56	0 56	1 58
30	6 57	5 32	23 52	24 48	0 48	1 47
20	6 37	5 19	23 44	24 35	0 35	1 29
10	6 20	5 04	23 37	24 24	0 24	1 14
0	6 03	4 48	23 30	24 13	0 13	0 59
10	5 47	4 29	23 24	24 02	0 02	0 45
20	5 29	4 05	23 16	23 51	24 29	0 29
30	5 08	3 32	23 09	23 38	24 12	0 12
35	4 56	3 10	23 04	23 31	24 02	0 02
40	4 41	2 40	22 59	23 22	23 50	24 24
45	4 25	1 58	22 53	23 13	23 37	24 06
50	4 03	////	22 46	23 01	23 20	23 45
52	3 53	////	22 43	22 56	23 13	23 35
54	3 42	////	22 39	22 50	23 04	23 24
56	3 29	////	22 35	22 43	22 55	23 11
58	3 14	////	22 31	22 36	22 44	22 56
60 S	2 56	////	22 26	22 28	22 32	22 38

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 7 h m	8 h m	9 h m	10 h m
72	▬	17 26	9 49	9 14	8 17	▬
70	▬	17 34	9 58	9 32	8 56	▬
68	13 04	17 40	10 05	9 47	9 23	8 40
66	14 01	17 45	10 11	9 59	9 44	9 22
64	14 34	17 50	10 16	10 09	10 01	9 51
62	14 58	17 54	10 20	10 18	10 15	10 14
60	15 17	17 58	10 24	10 25	10 27	10 32
58	15 32	18 01	10 27	10 32	10 37	10 47
56	15 46	18 05	10 30	10 37	10 47	10 59
54	15 57	18 08	10 33	10 43	10 55	11 11
52	16 08	18 12	10 36	10 47	11 02	11 21
50	16 17	18 15	10 38	10 52	11 09	11 30
45	16 36	18 22	10 43	11 01	11 23	11 49
40	16 52	18 29	10 47	11 09	11 34	12 04
35	17 05	18 35	10 51	11 16	11 44	12 18
30	17 17	18 42	10 54	11 22	11 53	12 29
20	17 37	18 55	10 59	11 32	12 08	12 49
10	17 54	19 09	11 04	11 42	12 22	13 06
0	18 11	19 25	11 09	11 50	12 34	13 23
10	18 27	19 44	11 14	11 59	12 47	13 39
20	18 45	20 08	11 19	12 08	13 01	13 56
30	19 06	20 41	11 24	12 19	13 16	14 17
35	19 18	21 02	11 28	12 25	13 25	14 29
40	19 32	21 31	11 31	12 32	13 36	14 42
45	19 49	22 13	11 36	12 40	13 48	14 58
50	20 10	////	11 41	12 50	14 03	15 19
52	20 20	////	11 43	12 55	14 10	15 28
54	20 31	////	11 46	13 00	14 18	15 39
56	20 44	////	11 49	13 06	14 27	15 51
58	20 59	////	11 52	13 12	14 37	16 06
60 S	21 17	////	11 56	13 19	14 48	16 22

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
7	4 59	15 12	15 25	19 27	6 36
8	5 40	15 12	15 24	19 24	6 32
9	6 24	15 13	15 23	19 20	6 29
10	7 11	15 13	15 22	19 16	6 25

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	7 ′	8 ′	9 ′
0	12.5	13.1	14.0
4	12.5	13.1	14.0
8	12.5	13.2	14.0
12	12.6	13.2	14.1
16	12.6	13.2	14.1
20	12.7	13.3	14.1
24	12.7	13.3	14.1
28	12.8	13.4	14.2
32	12.9	13.5	14.2
36	13.0	13.5	14.3
40	13.1	13.6	14.3
44	13.2	13.7	14.4
48	13.4	13.8	14.5
52	13.5	13.9	14.5
56	13.6	14.0	14.6
60	13.8	14.1	14.7
64	13.9	14.3	14.7
68	14.1	14.4	14.8
72	14.2	14.5	14.9
76	14.4	14.6	15.0
80	14.6	14.8	15.1
84	14.7	14.9	15.1
88	14.9	15.0	15.2
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	7 ′	8 ′	9 ′
0	17.3	16.9	16.4
4	17.3	16.9	16.4
8	17.3	16.9	16.4
12	17.2	16.9	16.4
16	17.2	16.8	16.4
20	17.1	16.8	16.3
24	17.1	16.7	16.3
28	17.0	16.7	16.3
32	16.9	16.6	16.2
36	16.8	16.5	16.2
40	16.7	16.4	16.1
44	16.6	16.4	16.1
48	16.4	16.3	16.0
52	16.3	16.2	15.9
56	16.2	16.0	15.9
60	16.0	15.9	15.8
64	15.9	15.8	15.7
68	15.7	15.7	15.6
72	15.6	15.6	15.6
76	15.4	15.4	15.5
80	15.2	15.3	15.4
84	15.1	15.2	15.3
88	14.9	15.1	15.2
90			

Subtract from table, back cover

Last Quarter 8

GMT	♈ GHA	VENUS −3.8 GHA	VENUS −3.8 Dec.	MARS 1.2 GHA	MARS 1.2 Dec.	JUPITER −2.2 GHA	JUPITER −2.2 Dec.	SATURN 0.9 GHA	SATURN 0.9 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
10 0	109 13.2	131 49.4	−10 44.2	129 25.4	− 9 29.3	70 17.3	+14 06.9	263 32.9	− 7 59.8	255 51.8	119	−18 57.8	−108
1	124 15.6	146 49.3	43.0	144 26.0	28.5	85 19.7	07.0	278 35.2	59.9	270 22.7	118	19 08.6	−107
2	139 18.1	161 49.1	41.8	159 26.7	27.8	100 22.2	07.0	293 37.6	59.9	284 53.5	117	19 19.3	−106
3	154 20.5	176 49.0	·· 40.7	174 27.4	·· 27.0	115 24.6	·· 07.0	308 40.0	· 7 59.9	299 24.2	115	·19 29.9	−106
4	169 23.0	191 48.9	39.5	189 28.0	26.3	130 27.0	07.0	323 42.3	8 00.0	313 54.7	115	19 40.5	−105
5	184 25.5	206 48.7	38.3	204 28.7	25.5	145 29.4	07.1	338 44.7	00.0	328 25.2	113	19 51.0	−104
6	199 27.9	221 48.6	−10 37.1	219 29.4	− 9 24.8	160 31.9	+14 07.1	353 47.0	− 8 00.0	342 55.5	113	−20 01.4	−103
7	214 30.4	236 48.5	35.9	234 30.0	24.0	175 34.3	07.1	8 49.4	00.1	357 25.8	111	20 11.7	−102
8	229 32.9	251 48.4	34.7	249 30.7	23.3	190 36.7	07.1	23 51.7	00.1	11 55.9	110	20 21.9	−101
9	244 35.3	266 48.2	·· 33.6	264 31.4	·· 22.5	205 39.1	·· 07.2	38 54.1	·· 00.1	26 25.9	109	·20 32.0	−101
10	259 37.8	281 48.1	32.4	279 32.0	21.8	220 41.6	07.2	53 56.4	00.1	40 55.8	108	20 42.1	− 99
11	274 40.3	296 48.0	31.2	294 32.7	21.0	235 44.0	07.2	68 58.8	00.2	55 25.6	106	20 52.0	− 99
12	289 42.7	311 47.9	−10 30.0	309 33.4	− 9 20.3	250 46.4	+14 07.2	84 01.2	− 8 00.2	69 55.2	106	−21 01.9	− 98
13	304 45.2	326 47.7	28.8	324 34.1	19.5	265 48.8	07.3	99 03.5	00.2	84 24.8	104	21 11.7	− 97
14	319 47.6	341 47.6	27.6	339 34.7	18.8	280 51.3	07.3	114 05.9	00.3	98 54.2	103	21 21.4	− 95
15	334 50.1	356 47.5	·· 26.5	354 35.4	·· 18.0	295 53.7	·· 07.3	129 08.2	·· 00.3	113 23.5	102	·21 30.9	− 95
16	349 52.6	11 47.4	25.3	9 36.1	17.3	310 56.1	07.4	144 10.6	00.3	127 52.7	101	21 40.4	− 94
17	4 55.0	26 47.3	24.1	24 36.7	16.5	325 58.5	07.4	159 12.9	00.4	142 21.8	99	21 49.8	− 93
18	19 57.5	41 47.1	−10 22.9	39 37.4	− 9 15.7	341 01.0	+14 07.4	174 15.3	− 8 00.4	156 50.7	99	−21 59.1	− 92
19	35 00.0	56 47.0	21.7	54 38.1	15.0	356 03.4	07.4	189 17.6	00.4	171 19.6	97	22 08.3	− 91
20	50 02.4	71 46.9	20.5	69 38.7	14.2	11 05.8	07.5	204 20.0	00.4	185 48.3	96	22 17.4	− 90
21	65 04.9	86 46.8	·· 19.3	84 39.4	·· 13.5	26 08.2	·· 07.5	219 22.4	·· 00.5	200 16.9	95	·22 26.4	− 89
22	80 07.4	101 46.7	18.2	99 40.1	12.7	41 10.6	07.5	234 24.7	00.5	214 45.4	94	22 35.3	− 87
23	95 09.8	116 46.5	17.0	114 40.8	12.0	56 13.1	07.5	249 27.1	00.5	229 13.8	92	22 44.0	− 87
11 0	110 12.3	131 46.4	−10 15.8	129 41.4	− 9 11.2	71 15.5	+14 07.6	264 29.4	− 8 00.6	243 42.0	91	−22 52.7	− 85
1	125 14.8	146 46.3	14.6	144 42.1	10.5	86 17.9	07.6	279 31.8	00.6	258 10.1	91	23 01.2	− 85
2	140 17.2	161 46.2	13.4	159 42.8	09.7	101 20.3	07.6	294 34.1	00.6	272 38.2	88	23 09.7	− 83
3	155 19.7	176 46.1	·· 12.2	174 43.4	·· 09.0	116 22.7	·· 07.6	309 36.5	·· 00.6	287 06.0	88	·23 18.0	− 82
4	170 22.1	191 46.0	11.0	189 44.1	08.2	131 25.2	07.7	324 38.9	00.7	301 33.8	87	23 26.2	− 81
5	185 24.6	206 45.9	09.8	204 44.8	07.5	146 27.6	07.7	339 41.2	00.7	316 01.5	85	23 34.3	− 80
6	200 27.1	221 45.8	−10 08.6	219 45.5	− 9 06.7	161 30.0	+14 07.7	354 43.6	− 8 00.7	330 29.0	84	−23 42.3	− 78
7	215 29.5	236 45.6	07.5	234 46.1	05.9	176 32.4	07.8	9 45.9	00.8	344 56.4	83	23 50.1	− 78
8	230 32.0	251 45.5	06.3	249 46.8	05.2	191 34.8	07.8	24 48.3	00.8	359 23.7	81	23 57.9	− 76
9	245 34.5	266 45.4	·· 05.1	264 47.5	·· 04.4	206 37.3	·· 07.8	39 50.7	·· 00.8	13 50.8	81	·24 05.5	− 74
10	260 36.9	281 45.3	03.9	279 48.1	03.7	221 39.7	07.8	54 53.0	00.8	28 17.9	79	24 12.9	− 74
11	275 39.4	296 45.2	02.7	294 48.8	02.9	236 42.1	07.9	69 55.4	00.9	42 44.8	78	24 20.3	− 72
12	290 41.9	311 45.1	−10 01.5	309 49.5	− 9 02.2	251 44.5	+14 07.9	84 57.7	− 8 00.9	57 11.6	77	−24 27.5	− 71
13	305 44.3	326 45.0	10 00.3	324 50.2	01.4	266 46.9	07.9	100 00.1	00.9	71 38.3	76	24 34.6	− 70
14	320 46.8	341 44.9	9 59.1	339 50.8	9 00.7	281 49.3	08.0	115 02.5	01.0	86 04.9	75	24 41.6	− 68
15	335 49.3	356 44.8	·· 57.9	354 51.5	· 8 59.9	296 51.8	·· 08.0	130 04.8	·· 01.0	100 31.4	73	·24 48.4	− 67
16	350 51.7	11 44.7	56.7	9 52.2	59.1	311 54.2	08.0	145 07.2	01.0	114 57.7	72	24 55.1	− 66
17	5 54.2	26 44.6	55.5	24 52.9	58.4	326 56.6	08.0	160 09.5	01.0	129 23.9	71	25 01.7	− 64
18	20 56.6	41 44.5	− 9 54.3	39 53.5	− 8 57.6	341 59.0	+14 08.1	175 11.9	− 8 01.1	143 50.0	70	−25 08.1	− 63
19	35 59.1	56 44.4	53.1	54 54.2	56.9	357 01.4	08.1	190 14.3	01.1	158 16.0	69	25 14.4	− 62
20	51 01.6	71 44.3	52.0	69 54.9	56.1	12 03.8	08.1	205 16.6	01.1	172 41.9	68	25 20.6	− 60
21	66 04.0	86 44.2	·· 50.8	84 55.6	·· 55.4	27 06.2	·· 08.2	220 19.0	·· 01.2	187 07.7	66	·25 26.6	− 58
22	81 06.5	101 44.1	49.6	99 56.2	54.6	42 08.6	08.2	235 21.3	01.2	201 33.3	65	25 32.4	− 57
23	96 09.0	116 44.0	48.4	114 56.9	53.8	57 11.1	08.2	250 23.7	01.2	215 58.8	65	25 38.1	− 56
12 0	111 11.4	131 43.9	− 9 47.2	129 57.6	− 8 53.1	72 13.5	+14 08.2	265 26.1	− 8 01.2	230 24.3	63	−25 43.7	− 54
1	126 13.9	146 43.8	46.0	144 58.3	52.3	87 15.9	08.3	280 28.4	01.3	244 49.6	62	25 49.1	− 53
2	141 16.4	161 43.7	44.8	159 58.9	51.6	102 18.3	08.3	295 30.8	01.3	259 14.8	61	25 54.4	− 51
3	156 18.8	176 43.6	·· 43.6	174 59.6	·· 50.8	117 20.7	·· 08.3	310 33.1	·· 01.3	273 39.9	60	·25 59.5	− 50
4	171 21.3	191 43.5	42.4	190 00.3	50.1	132 23.1	08.4	325 35.5	01.3	288 04.9	59	26 04.5	− 48
5	186 23.8	206 43.4	41.2	205 01.0	49.3	147 25.5	08.4	340 37.9	01.4	302 29.8	58	26 09.3	− 46
6	201 26.2	221 43.3	− 9 40.0	220 01.6	− 8 48.5	162 27.9	+14 08.4	355 40.2	− 8 01.4	316 54.6	56	−26 13.9	− 45
7	216 28.7	236 43.2	38.8	235 02.3	47.8	177 30.3	08.5	10 42.6	01.4	331 19.2	56	26 18.4	− 43
8	231 31.1	251 43.1	37.6	250 03.0	47.0	192 32.8	08.5	25 45.0	01.5	345 43.8	55	26 22.7	− 42
9	246 33.6	266 43.0	·· 36.4	265 03.7	·· 46.3	207 35.2	·· 08.5	40 47.3	·· 01.5	0 08.3	54	·26 26.9	− 40
10	261 36.1	281 42.9	35.2	280 04.3	45.5	222 37.6	08.5	55 49.7	01.5	14 32.7	53	26 30.9	− 39
11	276 38.5	296 42.9	34.0	295 05.0	44.8	237 40.0	08.6	70 52.0	01.5	28 57.0	52	26 34.8	− 37
12	291 41.0	311 42.8	− 9 32.8	310 05.7	− 8 44.0	252 42.4	+14 08.6	85 54.4	− 8 01.6	43 21.2	51	−26 38.5	− 35
13	306 43.5	326 42.7	31.6	325 06.4	43.2	267 44.8	08.6	100 56.8	01.6	57 45.3	50	26 42.0	− 33
14	321 45.9	341 42.6	30.4	340 07.0	42.5	282 47.2	08.7	115 59.1	01.6	72 09.3	49	26 45.3	− 32
15	336 48.4	356 42.5	·· 29.2	355 07.7	·· 41.7	297 49.6	·· 08.7	131 01.5	·· 01.6	86 33.2	48	·26 48.5	− 30
16	351 50.9	11 42.4	28.0	10 08.4	41.0	312 52.0	08.7	146 03.9	01.7	100 57.0	47	26 51.5	− 28
17	6 53.3	26 42.3	26.8	25 09.1	40.2	327 54.4	08.8	161 06.2	01.7	115 20.7	47	26 54.3	− 27
18	21 55.8	41 42.2	− 9 25.6	40 09.7	− 8 39.4	342 56.8	+14 08.8	176 08.6	− 8 01.7	129 44.4	45	−26 57.0	− 25
19	36 58.2	56 42.2	24.4	55 10.4	38.7	357 59.2	08.8	191 11.0	01.7	144 07.9	45	26 59.5	− 23
20	52 00.7	71 42.1	23.2	70 11.1	37.9	13 01.6	08.9	206 13.3	01.8	158 31.4	44	27 01.8	− 22
21	67 03.2	86 42.0	·· 22.0	85 11.8	·· 37.2	28 04.0	·· 08.9	221 15.7	·· 01.8	172 54.8	44	·27 04.0	− 19
22	82 05.6	101 41.9	20.8	100 12.4	36.4	43 06.4	08.9	236 18.1	01.8	187 18.2	42	27 05.9	− 18
23	97 08.1	116 41.8	19.6	115 13.1	35.7	58 08.8	09.0	251 20.4	01.8	201 41.4	42	27 07.7	− 16
24	112 10.6	131 41.8	− 9 18.4	130 13.8	− 8 34.9	73 11.2	+14 09.0	266 22.8	− 8 01.9	216 04.6	41	−27 09.3	− 14
code	−	− 1	+ 12	+ 7	+ 8	+ 24	0	+ 24	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
10 0	178 09.4	−22 02.1
1	193 09.2	01.8
2	208 08.9	01.4
3	223 08.7	01.0
4	238 08.4	00.7
5	253 08.1	22 00.3
6	268 07.9	−21 59.9
7	283 07.6	59.6
8	298 07.4	59.2
9	313 07.1	58.8
10	328 06.9	58.4
11	343 06.6	58.1
12	358 06.4	−21 57.7
13	13 06.1	57.3
14	28 05.9	57.0
15	43 05.6	56.6
16	58 05.3	56.2
17	73 05.1	55.8
18	88 04.8	−21 55.4
19	103 04.6	55.1
20	118 04.3	54.7
21	133 04.1	54.3
22	148 03.8	53.9
23	163 03.6	53.5
11 0	178 03.3	−21 53.2
1	193 03.1	52.8
2	208 02.8	52.4
3	223 02.6	52.0
4	238 02.3	51.6
5	253 02.1	51.2
6	268 01.8	−21 50.9
7	283 01.6	50.5
8	298 01.3	50.1
9	313 01.1	49.7
10	328 00.8	49.3
11	343 00.6	48.9
12	358 00.3	−21 48.5
13	13 00.1	48.1
14	27 59.8	47.7
15	42 59.6	47.4
16	57 59.4	47.0
17	72 59.1	46.6
18	87 58.9	−21 46.2
19	102 58.6	45.8
20	117 58.4	45.4
21	132 58.1	45.0
22	147 57.9	44.6
23	162 57.6	44.2
12 0	177 57.4	−21 43.8
1	192 57.1	43.4
2	207 56.9	43.0
3	222 56.7	42.6
4	237 56.4	42.2
5	252 56.2	41.8
6	267 55.9	−21 41.4
7	282 55.7	41.0
8	297 55.4	40.6
9	312 55.2	40.2
10	327 55.0	39.7
11	342 54.7	39.3
12	357 54.5	−21 38.9
13	12 54.2	38.5
14	27 54.0	38.1
15	42 53.8	37.7
16	57 53.5	37.3
17	72 53.3	36.9
18	87 53.0	−21 36.5
19	102 52.8	36.1
20	117 52.6	35.6
21	132 52.3	35.2
22	147 52.1	34.8
23	162 51.8	34.4
24	177 51.6	−21 34.0
code	−	+ 4

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.4	−40 29.6
5	Achernar	336 00.2	−57 28.7
30	Acrux	174 00.2	−62 50.2
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.1	+56 12.5
34	Alkaid	153 34.4	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.6	+26 52.0
1	Alpheratz	358 30.7	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.3	−42 33.8
42	Antares	113 22.2	−26 19.8
37	Arcturus	146 37.1	+19 25.3
43	Atria	109 05.3	−68 56.6
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 20.3	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.2
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.7	+14 49.9
4	Diphda	349 41.3	−18 14.7
27	Dubhe	194 46.5	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.7	+51 29.4
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.6	−56 50.9
29	Gienah	176 38.9	−17 16.9
35	Hadar	149 52.7	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.3	−34 24.6
40	Kochab	137 18.0	+74 20.4
57	Markab	14 23.7	+14 57.2
8	Menkar	315 02.3	+ 3 54.5
36	Menkent	149 01.3	−36 08.4
24	Miapl'dus	221 48.9	−69 31.3
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.4
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.8	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.2	−60 38.5
44	Sabik	103 04.9	−15 40.2
3	Schedar	350 32.6	+56 17.2
45	Shaula	97 23.9	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.1	−10 55.1
23	Suhail	223 25.5	−43 14.4
49	Vega	81 10.1	+38 44.2
39	Zub'g'hi	137 55.8	−15 51.0

GMT	Equation of Time (App.—Mean) 10	11	12
h	m s	m s	m s
0	− 7 21.8	− 7 46.2	− 8 09.9
6	− 7 28.0	− 7 52.2	− 8 15.8
12	− 7 34.1	− 7 58.1	− 8 21.6
18	− 7 40.1	− 8 04.1	− 8 27.4
24	− 7 46.2	− 8 09.9	− 8 33.1

Lat.	Sunrise	Twlt. begins	Moonrise 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	▬	6 44	▬	▬	▬	▬
70	▬	6 37	▬	▬	▬	▬
68	10 54	6 32	5 25	▬	▬	▬
66	10 05	6 28	4 44	▬	▬	▬
64	9 35	6 23	4 16	6 20	▬	▬
62	9 12	6 18	3 55	5 42	7 34	9 07
60	8 54	6 15	3 37	5 15	6 52	8 12
58	8 39	6 12	3 23	4 54	6 24	7 39
56	8 26	6 09	3 11	4 37	6 02	7 15
54	8 14	6 05	3 00	4 23	5 44	6 55
52	8 04	6 02	2 51	4 10	5 29	6 39
50	7 56	5 59	2 42	3 59	5 15	6 24
45	7 37	5 52	2 24	3 36	4 48	5 56
40	7 22	5 46	2 10	3 18	4 27	5 33
35	7 09	5 39	1 58	3 03	4 09	5 14
30	6 57	5 32	1 47	2 49	3 54	4 58
20	6 38	5 19	1 29	2 27	3 28	4 31
10	6 20	5 05	1 14	2 08	3 06	4 07
0	6 04	4 50	0 59	1 50	2 45	3 46
10	5 48	4 31	0 45	1 32	2 25	3 24
20	5 31	4 07	0 29	1 13	2 03	3 01
30	5 10	3 35	0 12	0 51	1 38	2 34
35	4 58	3 13	0 02	0 38	1 23	2 18
40	4 44	2 45	24 24	0 24	1 06	1 59
45	4 28	2 04	24 06	0 06	0 45	1 37
50	4 07	0 27	23 45	24 20	0 20	1 09
52	3 58	////	23 35	24 07	0 07	0 55
54	3 47	////	23 24	23 53	24 39	0 39
56	3 34	////	23 11	23 37	24 20	0 20
58	3 19	////	22 56	23 17	23 57	25 05
60 S	3 02	////	22 38	22 53	23 27	24 35

Lat.	Sunset	Twlt. ends	Moonset 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	▬	17 32	▬	▬	▬	▬
70	▬	17 40	▬	▬	▬	▬
68	13 23	17 45	8 40	▬	▬	▬
66	14 11	17 50	9 22	▬	▬	▬
64	14 42	17 55	9 51	9 35	▬	▬
62	15 05	17 59	10 14	10 14	10 19	10 55
60	15 23	18 02	10 32	10 41	11 01	11 50
58	15 38	18 06	10 47	11 02	11 30	12 22
56	15 51	18 09	10 59	11 19	11 52	12 47
54	16 02	18 12	11 11	11 34	12 11	13 06
52	16 12	18 15	11 21	11 47	12 26	13 23
50	16 21	18 18	11 30	11 59	12 40	13 37
45	16 39	18 24	11 49	12 23	13 07	14 06
40	16 55	18 31	12 04	12 42	13 29	14 28
35	17 08	18 38	12 18	12 58	13 47	14 47
30	17 19	18 43	12 29	13 12	14 03	15 03
20	17 39	18 57	12 49	13 36	14 29	15 30
10	17 56	19 11	13 06	13 56	14 52	15 54
0	18 12	19 26	13 23	14 16	15 14	16 15
10	18 28	19 45	13 39	14 35	15 35	16 37
20	18 45	20 08	13 56	14 56	15 58	17 00
30	19 06	20 40	14 17	15 20	16 24	17 27
35	19 18	21 02	14 29	15 34	16 40	17 43
40	19 31	21 29	14 42	15 51	16 59	18 01
45	19 48	22 10	14 58	16 11	17 21	18 23
50	20 08	23 39	15 19	16 35	17 49	18 51
52	20 18	////	15 28	16 47	18 02	19 05
54	20 29	////	15 39	17 01	18 18	19 21
56	20 41	////	15 51	17 17	18 37	19 40
58	20 55	////	16 06	17 36	19 00	20 02
60 S	21 13	////	16 22	18 00	19 30	20 32

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
10	7 11	15 13	15 22	19 16	6 25
11	8 03	15 13	15 21	19 12	6 21
12	8 59	15 13	15 20	19 08	6 17
13	10 01	15 13	15 18	19 04	6 14

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	10	11	12
°	′	′	′
0	15.0	16.2	17.3
4	15.0	16.2	17.3
8	15.0	16.2	17.3
12	15.1	16.2	17.3
16	15.1	16.2	17.3
20	15.1	16.2	17.2
24	15.1	16.1	17.2
28	15.1	16.1	17.1
32	15.1	16.1	17.1
36	15.1	16.1	17.0
40	15.1	16.1	17.0
44	15.2	16.0	16.9
48	15.2	16.0	16.8
52	15.2	16.0	16.8
56	15.2	16.0	16.7
60	15.3	15.9	16.6
64	15.3	15.9	16.5
68	15.3	15.9	16.4
72	15.3	15.8	16.3
76	15.4	15.8	16.2
80	15.4	15.8	16.1
84	15.4	15.7	16.0
88	15.4	15.7	16.0
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	10	11	12
°	′	′	′
0	15.8	15.2	14.5
4	15.8	15.2	14.5
8	15.8	15.2	14.6
12	15.8	15.2	14.6
16	15.8	15.2	14.6
20	15.8	15.2	14.6
24	15.8	15.2	14.7
28	15.8	15.3	14.7
32	15.8	15.3	14.8
36	15.8	15.3	14.8
40	15.7	15.3	14.9
44	15.7	15.3	15.0
48	15.7	15.4	15.0
52	15.7	15.4	15.1
56	15.7	15.4	15.2
60	15.6	15.5	15.3
64	15.6	15.5	15.4
68	15.6	15.5	15.5
72	15.6	15.5	15.5
76	15.5	15.6	15.6
80	15.5	15.6	15.7
84	15.5	15.7	15.8
88	15.4	15.7	15.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.3 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
13 0	112 10.6	131 41.8	− 9 18.4	130 13.8	− 8 34.9	73 11.2	+14 09.0	266 22.8	− 8 01.9	216 04.6	41	−27 09.3	− 14
1	127 13.0	146 41.7	17.2	145 14.5	34.1	88 13.7	09.0	281 25.2	01.9	230 27.7	41	27 10.7	− 13
2	142 15.5	161 41.6	15.9	160 15.2	33.4	103 16.1	09.1	296 27.5	01.9	244 50.8	39	27 12.0	− 10
3	157 18.0	176 41.5	•• 14.7	175 15.8	•• 32.6	118 18.5	•• 09.1	311 29.9	•• 02.0	259 13.7	40	•27 13.0	− 9
4	172 20.4	191 41.4	13.5	190 16.5	31.9	133 20.9	09.1	326 32.2	02.0	273 36.7	38	27 13.9	− 7
5	187 22.9	206 41.4	12.3	205 17.2	31.1	148 23.3	09.2	341 34.6	02.0	287 59.5	38	27 14.6	− 5
6	202 25.4	221 41.3	− 9 11.1	220 17.9	− 8 30.3	163 25.7	+14 09.2	356 37.0	− 8 02.0	302 22.3	37	−27 15.1	− 3
7	217 27.8	236 41.2	09.9	235 18.6	29.6	178 28.1	09.2	11 39.3	02.1	316 45.0	37	27 15.4	− 1
8	232 30.3	251 41.1	08.7	250 19.2	28.8	193 30.5	09.3	26 41.7	02.1	331 07.7	37	27 15.5	0
9	247 32.7	266 41.1	•• 07.5	265 19.9	•• 28.1	208 32.9	•• 09.3	41 44.1	•• 02.1	345 30.4	35	•27 15.5	+ 3
10	262 35.2	281 41.0	06.3	280 20.6	27.3	223 35.3	09.3	56 46.4	02.1	359 52.9	36	27 15.2	+ 4
11	277 37.7	296 40.9	05.1	295 21.3	26.5	238 37.7	09.4	71 48.8	02.2	14 15.5	35	27 14.8	+ 6
12	292 40.1	311 40.8	− 9 03.9	310 21.9	− 8 25.8	253 40.1	+14 09.4	86 51.2	− 8 02.2	28 38.0	34	−27 14.2	+ 8
13	307 42.6	326 40.8	02.7	325 22.6	25.0	268 42.5	09.4	101 53.6	02.2	43 00.4	34	27 13.4	+ 10
14	322 45.1	341 40.7	01.5	340 23.3	24.2	283 44.9	09.5	116 55.9	02.2	57 22.8	34	27 12.4	+ 12
15	337 47.5	356 40.6	• 9 00.3	355 24.0	•• 23.5	298 47.3	•• 09.5	131 58.3	•• 02.3	71 45.2	34	•27 11.2	+ 14
16	352 50.0	11 40.6	8 59.1	10 24.7	22.7	313 49.7	09.5	147 00.7	02.3	86 07.6	33	27 09.8	+ 16
17	7 52.5	26 40.5	57.8	25 25.3	22.0	328 52.1	09.6	162 03.0	02.3	100 29.9	33	27 08.2	+ 18
18	22 54.9	41 40.4	− 8 56.6	40 26.0	− 8 21.2	343 54.4	+14 09.6	177 05.4	− 8 02.3	114 52.2	32	−27 06.4	+ 19
19	37 57.4	56 40.4	55.4	55 26.7	20.4	358 56.8	09.6	192 07.8	02.4	129 14.4	32	27 04.5	+ 22
20	52 59.9	71 40.3	54.2	70 27.4	19.7	13 59.2	09.7	207 10.1	02.4	143 36.6	33	27 02.3	+ 24
21	68 02.3	86 40.2	•• 53.0	85 28.1	•• 18.9	29 01.6	•• 09.7	222 12.5	•• 02.4	157 58.9	32	•26 59.9	+ 25
22	83 04.8	101 40.2	51.8	100 28.7	18.1	44 04.0	09.7	237 14.9	02.4	172 21.1	31	26 57.4	+ 27
23	98 07.2	116 40.1	50.6	115 29.4	17.4	59 06.4	09.8	252 17.2	02.5	186 43.2	32	26 54.7	+ 30
14 0	113 09.7	131 40.0	− 8 49.4	130 30.1	− 8 16.6	74 08.8	+14 09.8	267 19.6	− 8 02.5	201 05.4	32	−26 51.7	+ 31
1	128 12.2	146 40.0	48.2	145 30.8	15.9	89 11.2	09.8	282 22.0	02.5	215 27.6	31	26 48.6	+ 33
2	143 14.6	161 39.9	46.9	160 31.5	15.1	104 13.6	09.9	297 24.3	02.5	229 49.7	32	26 45.3	+ 35
3	158 17.1	176 39.8	•• 45.7	175 32.1	•• 14.3	119 16.0	•• 09.9	312 26.7	•• 02.5	244 11.9	31	•26 41.8	+ 38
4	173 19.6	191 39.8	44.5	190 32.8	13.6	134 18.4	09.9	327 29.1	02.6	258 34.0	32	26 38.0	+ 39
5	188 22.0	206 39.7	43.3	205 33.5	12.8	149 20.8	10.0	342 31.5	02.6	272 56.2	31	26 34.1	+ 41
6	203 24.5	221 39.7	− 8 42.1	220 34.2	− 8 12.0	164 23.2	+14 10.0	357 33.8	− 8 02.6	287 18.3	32	−26 30.0	+ 42
7	218 27.0	236 39.6	40.9	235 34.9	11.3	179 25.6	10.0	12 36.2	02.6	301 40.5	32	26 25.8	+ 45
8	233 29.4	251 39.6	39.7	250 35.6	10.5	194 28.0	10.1	27 38.6	02.7	316 02.7	32	26 21.3	+ 47
9	248 31.9	266 39.5	•• 38.5	265 36.2	•• 09.8	209 30.4	•• 10.1	42 40.9	•• 02.7	330 24.9	32	•26 16.6	+ 49
10	263 34.4	281 39.4	37.2	280 36.9	09.0	224 32.8	10.2	57 43.3	02.7	344 47.1	32	26 11.7	+ 50
11	278 36.8	296 39.4	36.0	295 37.6	08.2	239 35.1	10.2	72 45.7	02.7	359 09.3	32	26 06.7	+ 53
12	293 39.3	311 39.3	− 8 34.8	310 38.3	− 8 07.5	254 37.5	+14 10.2	87 48.0	− 8 02.8	13 31.5	33	−26 01.4	+ 54
13	308 41.7	326 39.3	33.6	325 39.0	06.7	269 39.9	10.3	102 50.4	02.8	27 53.8	32	25 56.0	+ 57
14	323 44.2	341 39.2	32.4	340 39.7	05.9	284 42.3	10.3	117 52.8	02.8	42 16.0	34	25 50.3	+ 58
15	338 46.7	356 39.2	•• 31.2	355 40.3	•• 05.2	299 44.7	•• 10.3	132 55.2	•• 02.8	56 38.4	33	•25 44.5	+ 60
16	353 49.1	11 39.1	29.9	10 41.0	04.4	314 47.1	10.4	147 57.5	02.9	71 00.7	34	25 38.5	+ 62
17	8 51.6	26 39.1	28.7	25 41.7	03.6	329 49.5	10.4	162 59.9	02.9	85 23.1	34	25 32.3	+ 64
18	23 54.1	41 39.0	− 8 27.5	40 42.4	− 8 02.9	344 51.9	+14 10.4	178 02.3	− 8 02.9	99 45.5	34	−25 25.9	+ 66
19	38 56.5	56 39.0	26.3	55 43.1	02.1	359 54.3	10.5	193 04.7	02.9	114 07.9	35	25 19.3	+ 67
20	53 59.0	71 38.9	25.1	70 43.7	01.4	14 56.6	10.5	208 07.0	03.0	128 30.4	35	25 12.6	+ 70
21	69 01.5	86 38.9	•• 23.9	85 44.4	• 8 00.6	29 59.0	•• 10.6	223 09.4	•• 03.0	142 52.9	36	•25 05.6	+ 71
22	84 03.9	101 38.8	22.6	100 45.1	7 59.8	45 01.4	10.6	238 11.8	03.0	157 15.5	36	24 58.5	+ 73
23	99 06.4	116 38.8	21.4	115 45.8	59.1	60 03.8	10.6	253 14.1	03.0	171 38.1	36	24 51.2	+ 75
15 0	114 08.9	131 38.7	− 8 20.2	130 46.5	− 7 58.3	75 06.2	+14 10.7	268 16.5	− 8 03.0	186 00.7	37	−24 43.7	+ 77
1	129 11.3	146 38.7	19.0	145 47.2	57.5	90 08.6	10.7	283 18.9	03.1	200 23.4	38	24 36.0	+ 78
2	144 13.8	161 38.6	17.8	160 47.9	56.8	105 11.0	10.7	298 21.3	03.1	214 46.2	38	24 28.2	+ 81
3	159 16.2	176 38.6	•• 16.6	175 48.5	•• 56.0	120 13.4	•• 10.8	313 23.6	•• 03.1	229 09.0	39	•24 20.1	+ 82
4	174 18.7	191 38.5	15.3	190 49.2	55.2	135 15.7	10.8	328 26.0	03.1	243 31.9	39	24 11.9	+ 84
5	189 21.2	206 38.5	14.1	205 49.9	54.5	150 18.1	10.9	343 28.4	03.2	257 54.8	40	24 03.5	+ 85
6	204 23.6	221 38.5	− 8 12.9	220 50.6	− 7 53.7	165 20.5	+14 10.9	358 30.8	− 8 03.2	272 17.8	40	−23 55.0	+ 88
7	219 26.1	236 38.4	11.7	235 51.3	52.9	180 22.9	10.9	13 33.1	03.2	286 40.8	41	23 46.2	+ 89
8	234 28.6	251 38.4	10.5	250 52.0	52.2	195 25.3	11.0	28 35.5	03.2	301 03.9	42	23 37.3	+ 91
9	249 31.0	266 38.3	•• 09.2	265 52.6	•• 51.4	210 27.7	•• 11.0	43 37.9	•• 03.2	315 27.1	42	•23 28.2	+ 92
10	264 33.5	281 38.3	08.0	280 53.3	50.6	225 30.0	11.0	58 40.3	03.3	329 50.3	43	23 19.0	+ 94
11	279 36.0	296 38.3	06.8	295 54.0	49.9	240 32.4	11.1	73 42.6	03.3	344 13.6	44	23 09.6	+ 96
12	294 38.4	311 38.2	− 8 05.6	310 54.7	− 7 49.1	255 34.8	+14 11.1	88 45.0	− 8 03.3	358 37.0	44	−23 00.0	+ 98
13	309 40.9	326 38.2	04.4	325 55.4	48.3	270 37.2	11.2	103 47.4	03.3	13 00.4	45	22 50.2	+ 99
14	324 43.3	341 38.2	03.1	340 56.1	47.6	285 39.6	11.2	118 49.8	03.4	27 23.9	46	22 40.3	+101
15	339 45.8	356 38.1	•• 01.9	355 56.8	•• 46.8	300 42.0	•• 11.2	133 52.1	•• 03.4	41 47.5	47	•22 30.2	+102
16	354 48.3	11 38.1	8 00.7	10 57.4	46.0	315 44.3	11.3	148 54.5	03.4	56 11.2	47	22 20.0	+104
17	9 50.7	26 38.0	7 59.5	25 58.1	45.3	330 46.7	11.3	163 56.9	03.4	70 34.9	48	22 09.6	+106
18	24 53.2	41 38.0	− 7 58.2	40 58.8	− 7 44.5	345 49.1	+14 11.4	178 59.3	− 8 03.4	84 58.7	49	−21 59.0	+107
19	39 55.7	56 38.0	57.0	55 59.5	43.7	0 51.5	11.4	194 01.6	03.5	99 22.6	50	21 48.3	+108
20	54 58.1	71 37.9	55.8	71 00.2	43.0	15 53.9	11.4	209 04.0	03.5	113 46.6	51	21 37.5	+111
21	70 00.6	86 37.9	•• 54.6	86 00.9	•• 42.2	30 56.2	•• 11.5	224 06.4	•• 03.5	128 10.7	51	•21 26.4	+111
22	85 03.1	101 37.9	53.4	101 01.6	41.4	45 58.6	11.5	239 08.8	03.5	142 34.8	52	21 15.3	+113
23	100 05.5	116 37.9	52.1	116 02.2	40.7	61 01.0	11.6	254 11.1	03.5	156 59.0	53	21 04.0	+115
24	115 08.0	131 37.8	− 7 50.9	131 02.9	− 7 39.9	76 03.4	+14 11.6	269 13.5	− 8 03.6	171 23.3	54	−20 52.5	+116
code	—	0	+ 12	+ 7	+ 8	+ 24	+ 1	+ 24	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
13 0	177 51.6	−21 34.0
1	192 51.4	33.6
2	207 51.1	33.1
3	222 50.9	32.7
4	237 50.6	32.3
5	252 50.4	31.9
6	267 50.2	−21 31.5
7	282 49.9	31.0
8	297 49.7	30.6
9	312 49.5	30.2
10	327 49.2	29.8
11	342 49.0	29.3
12	357 48.8	−21 28.9
13	12 48.5	28.5
14	27 48.3	28.1
15	42 48.1	27.6
16	57 47.8	27.2
17	72 47.6	26.8
18	87 47.4	−21 26.3
19	102 47.1	25.9
20	117 46.9	25.5
21	132 46.7	25.0
22	147 46.4	24.6
23	162 46.2	24.2
14 0	177 46.0	−21 23.7
1	192 45.7	23.3
2	207 45.5	22.9
3	222 45.3	22.4
4	237 45.0	22.0
5	252 44.8	21.6
6	267 44.6	−21 21.1
7	282 44.3	20.7
8	297 44.1	20.2
9	312 43.9	19.8
10	327 43.7	19.4
11	342 43.4	18.9
12	357 43.2	−21 18.5
13	12 43.0	18.0
14	27 42.7	17.6
15	42 42.5	17.1
16	57 42.3	16.7
17	72 42.1	16.3
18	87 41.8	−21 15.8
19	102 41.6	15.4
20	117 41.4	14.9
21	132 41.2	14.5
22	147 40.9	14.0
23	162 40.7	13.6
15 0	177 40.5	−21 13.1
1	192 40.3	12.7
2	207 40.0	12.2
3	222 39.8	11.7
4	237 39.6	11.3
5	252 39.4	10.8
6	267 39.1	−21 10.4
7	282 38.9	09.9
8	297 38.7	09.5
9	312 38.5	09.0
10	327 38.2	08.6
11	342 38.0	08.1
12	357 37.8	−21 07.6
13	12 37.6	07.2
14	27 37.4	06.7
15	42 37.1	06.2
16	57 36.9	05.8
17	72 36.7	05.3
18	87 36.5	−21 04.9
19	102 36.3	04.4
20	117 36.0	03.9
21	132 35.8	03.5
22	147 35.6	03.0
23	162 35.4	02.5
24	177 35.2	−21 02.1
code	−	+ 5

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.4	−40 29.6
5	Achernar	336 00.2	−57 28.7
30	Acrux	174 00.1	−62 50.2
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.1	+56 12.5
34	Alkaid	153 34.4	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.5	+26 52.0
1	Alpheratz	358 30.7	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.3	−42 33.8
42	Antares	113 22.2	−26 19.8
37	Arcturus	146 37.1	+19 25.3
43	Atria	109 05.3	−68 56.6
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 20.3	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.2
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.5	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.7	+51 29.4
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.6	−56 50.9
29	Gienah	176 38.9	−17 16.9
35	Hadar	149 52.6	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.3	−34 24.6
40	Kochab	137 17.9	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.3	+ 3 54.5
36	Menkent	149 01.2	−36 08.4
24	Miapl'dus	221 48.9	−69 31.3
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.4
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.8	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.1	−60 38.5
44	Sabik	103 04.8	−15 40.2
3	Schedar	350 32.6	+56 17.2
45	Shaula	97 23.9	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.1	−10 55.1
23	Suhail	223 25.5	−43 14.5
49	Vega	81 10.1	+38 44.2
39	Zub'g'bi	137 55.8	−15 51.0

GMT	Equation of Time (App.—Mean) 13	14	15
h	m s	m s	m s
0	− 8 33.1	− 8 55.7	− 9 17.7
6	− 8 38.8	− 9 01.3	− 9 23.0
12	− 8 44.5	− 9 06.8	− 9 28.4
18	− 8 50.1	− 9 12.2	− 9 33.7
24	− 8 55.7	− 9 17.7	− 9 38.9

Lat.	Sunrise	Twlt. begins	Moonrise 13	14	15	16
N °	h m	h m	h m	h m	h m	h m
72	▬	6 39	▬	▬	▬	▬
70	▬	6 34	▬	▬	▬	11 34
68	10 39	6 29	▬	▬	▬	10 50
66	9 57	6 24	▬	▬	11 04	10 20
64	9 28	6 20	▬	▬	10 12	9 58
62	9 07	6 17	9 07	9 35	9 40	9 40
60	8 50	6 13	8 12	8 56	9 16	9 24
58	8 35	6 09	7 39	8 29	8 56	9 12
56	8 23	6 07	7 15	8 07	8 40	9 00
54	8 12	6 04	6 55	7 49	8 26	8 50
52	8 02	6 00	6 39	7 34	8 14	8 42
50	7 54	5 57	6 24	7 21	8 03	8 34
45	7 35	5 51	5 56	6 54	7 40	8 17
40	7 21	5 45	5 33	6 32	7 22	8 03
35	7 08	5 39	5 14	6 14	7 06	7 51
30	6 57	5 33	4 58	5 59	6 53	7 40
20	6 38	5 20	4 31	5 32	6 30	7 22
10	6 21	5 07	4 07	5 10	6 10	7 06
0	6 05	4 51	3 46	4 49	5 51	6 51
10	5 50	4 33	3 24	4 27	5 32	6 36
20	5 33	4 10	3 01	4 05	5 12	6 20
30	5 13	3 38	2 34	3 38	4 49	6 02
35	5 01	3 17	2 18	3 23	4 35	5 51
40	4 48	2 49	1 59	3 05	4 19	5 39
45	4 32	2 10	1 37	2 43	4 00	5 24
50	4 12	0 50	1 09	2 15	3 36	5 06
52	4 02	////	0 55	2 01	3 25	4 57
54	3 52	////	0 39	1 46	3 12	4 47
56	3 40	////	0 20	1 27	2 57	4 36
58	3 26	////	25 05	1 05	2 39	4 24
60	3 09	////	24 35	0 35	2 16	4 09

Lat.	Sunset	Twlt. ends	Moonset 13	14	15	16
N °	h m	h m	h m	h m	h m	h m
72	▬	17 40	▬	▬	▬	▬
70	▬	17 46	▬	▬	▬	14 59
68	13 40	17 51	▬	▬	▬	15 42
66	14 22	17 56	▬	▬	13 21	16 10
64	14 51	18 00	▬	▬	14 13	16 31
62	15 12	18 04	10 55	12 38	14 44	16 48
60	15 29	18 07	11 50	13 17	15 08	17 02
58	15 44	18 10	12 22	13 45	15 27	17 14
56	15 56	18 13	12 47	14 06	15 42	17 24
54	16 07	18 16	13 06	14 23	15 56	17 33
52	16 16	18 18	13 23	14 38	16 07	17 41
50	16 25	18 21	13 37	14 51	16 18	17 49
45	16 43	18 27	14 06	15 18	16 39	18 04
40	16 58	18 34	14 28	15 39	16 57	18 17
35	17 11	18 40	14 47	15 56	17 11	18 27
30	17 22	18 46	15 03	16 11	17 24	18 36
20	17 41	18 59	15 30	16 37	17 45	18 52
10	17 57	19 11	15 54	16 58	18 03	19 06
0	18 13	19 27	16 15	17 18	18 20	19 19
10	18 29	19 45	16 37	17 39	18 37	19 31
20	18 46	20 08	17 00	18 00	18 55	19 45
30	19 05	20 38	17 27	18 25	19 16	20 00
35	19 17	21 00	17 43	18 39	19 27	20 08
40	19 30	21 26	18 01	18 56	19 41	20 18
45	19 46	22 05	18 23	19 16	19 57	20 30
50	20 06	23 21	18 51	19 41	20 17	20 44
52	20 15	////	19 05	19 52	20 26	20 50
54	20 26	////	19 21	20 06	20 36	20 57
56	20 38	////	19 40	20 22	20 48	21 05
58	20 51	////	20 02	20 40	21 01	21 14
60	21 08	////	20 32	21 03	21 17	21 24

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
13	10 01	15 13	15 18	19 04	6 14
14	11 04	15 13	15 17	19 00	6 10
15	12 06	15 14	15 16	18 57	6 06
16	13 05	15 14	15 15	18 53	6 02

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	13	14	15
°	′	′	′
0	18.5	19.4	20.1
4	18.5	19.4	20.1
8	18.4	19.3	20.1
12	18.4	19.3	20.0
16	18.4	19.2	20.0
20	18.3	19.2	19.9
24	18.2	19.1	19.8
28	18.2	19.0	19.7
32	18.1	18.9	19.5
36	18.0	18.7	19.4
40	17.9	18.6	19.2
44	17.8	18.5	19.0
48	17.7	18.3	18.8
52	17.5	18.1	18.6
56	17.4	18.0	18.4
60	17.3	17.8	18.2
64	17.1	17.6	18.0
68	17.0	17.4	17.8
72	16.8	17.2	17.5
76	16.7	17.0	17.3
80	16.5	16.8	17.0
84	16.3	16.6	16.8
88	16.2	16.4	16.6
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	13	14	15
°	′	′	′
0	13.9	13.4	12.9
4	13.9	13.4	13.0
8	13.9	13.4	13.0
12	13.9	13.5	13.0
16	14.0	13.5	13.1
20	14.0	13.6	13.2
24	14.1	13.7	13.3
28	14.2	13.8	13.4
32	14.3	13.9	13.5
36	14.4	14.0	13.7
40	14.5	14.1	13.9
44	14.6	14.3	14.0
48	14.7	14.4	14.2
52	14.8	14.6	14.4
56	15.0	14.8	14.6
60	15.1	15.0	14.8
64	15.2	15.1	15.1
68	15.4	15.3	15.3
72	15.5	15.5	15.5
76	15.7	15.7	15.8
80	15.9	15.9	16.0
84	16.0	16.2	16.3
88	16.1	16.3	16.5
90			

Subtract from table, back cover

New Moon 15

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.3 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
16 0	115 08.0	131 37.8	− 7 50.9	131 02.9	− 7 39.9	76 03.4	+14 11.6	269 13.5	− 8 03.6	171 23.3	54	−20 52.5	+116
1	130 10.5	146 37.8	49.7	146 03.6	39.1	91 05.8	11.6	284 15.9	03.6	185 47.7	54	20 40.9	+118
2	145 12.9	161 37.8	48.5	161 04.3	38.4	106 08.1	11.7	299 18.3	03.6	200 12.1	56	20 29.1	+119
3	160 15.4	176 37.7	47.2	176 05.0	37.6	121 10.5	11.7	314 20.7	03.6	214 36.7	56	20 17.2	+120
4	175 17.8	191 37.7	46.0	191 05.7	36.8	136 12.9	11.8	329 23.0	03.7	229 01.3	57	20 05.2	+122
5	190 20.3	206 37.7	44.8	206 06.4	36.1	151 15.3	11.8	344 25.4	03.7	243 26.0	58	19 53.0	+123
6	205 22.8	221 37.7	− 7 43.6	221 07.1	− 7 35.3	166 17.6	+14 11.8	359 27.8	− 8 03.7	257 50.8	59	−19 40.7	+124
7	220 25.2	236 37.6	42.3	236 07.7	34.5	181 20.0	11.9	14 30.2	03.7	272 15.7	60	19 28.3	+126
8	235 27.7	251 37.6	41.1	251 08.4	33.8	196 22.4	11.9	29 32.5	03.7	286 40.7	61	19 15.7	+127
9	250 30.2	266 37.6	39.9	266 09.1	33.0	211 24.8	12.0	44 34.9	03.8	301 05.8	61	19 03.0	+128
10	265 32.6	281 37.6	38.6	281 09.8	32.2	226 27.1	12.0	59 37.3	03.8	315 30.9	63	18 50.2	+130
11	280 35.1	296 37.6	37.4	296 10.5	31.5	241 29.5	12.0	74 39.7	03.8	329 56.2	63	18 37.2	+131
12	295 37.6	311 37.5	− 7 36.2	311 11.2	− 7 30.7	256 31.9	+14 12.1	89 42.1	− 8 03.8	344 21.5	64	−18 24.1	+132
13	310 40.0	326 37.5	35.0	326 11.9	29.9	271 34.3	12.1	104 44.4	03.8	358 46.9	65	18 10.9	+133
14	325 42.5	341 37.5	33.7	341 12.6	29.1	286 36.6	12.2	119 46.8	03.9	13 12.4	66	17 57.6	+135
15	340 45.0	356 37.5	32.5	356 13.3	28.4	301 39.0	12.2	134 49.2	03.9	27 38.0	67	17 44.1	+135
16	355 47.4	11 37.5	31.3	11 13.9	27.6	316 41.4	12.3	149 51.6	03.9	42 03.7	68	17 30.6	+137
17	10 49.9	26 37.4	30.1	26 14.6	26.8	331 43.8	12.3	164 54.0	03.9	56 29.5	69	17 16.9	+138
18	25 52.3	41 37.4	− 7 28.8	41 15.3	− 7 26.1	346 46.1	+14 12.3	179 56.3	− 8 03.9	70 55.4	69	−17 03.1	+139
19	40 54.8	56 37.4	27.6	56 16.0	25.3	1 48.5	12.4	194 58.7	04.0	85 21.3	70	16 49.2	+140
20	55 57.3	71 37.4	26.4	71 16.7	24.5	16 50.9	12.4	210 01.1	04.0	99 47.3	72	16 35.2	+141
21	70 59.7	86 37.4	25.1	86 17.4	23.8	31 53.2	12.5	225 03.5	04.0	114 13.5	72	16 21.1	+142
22	86 02.2	101 37.4	23.9	101 18.1	23.0	46 55.6	12.5	240 05.9	04.0	128 39.7	73	16 06.9	+143
23	101 04.7	116 37.4	22.7	116 18.8	22.2	61 58.0	12.5	255 08.2	04.0	143 06.0	74	15 52.6	+144
17 0	116 07.1	131 37.3	− 7 21.5	131 19.5	− 7 21.5	77 00.3	+14 12.6	270 10.6	− 8 04.1	157 32.4	75	−15 38.2	+145
1	131 09.6	146 37.3	20.2	146 20.1	20.7	92 02.7	12.6	285 13.0	04.1	171 58.9	75	15 23.7	+146
2	146 12.1	161 37.3	19.0	161 20.8	19.9	107 05.1	12.7	300 15.4	04.1	186 25.4	77	15 09.1	+147
3	161 14.5	176 37.3	17.8	176 21.5	19.1	122 07.5	12.7	315 17.8	04.1	200 52.1	77	14 54.4	+148
4	176 17.0	191 37.3	16.5	191 22.2	18.4	137 09.8	12.8	330 20.2	04.1	215 18.8	79	14 39.6	+149
5	191 19.5	206 37.3	15.3	206 22.9	17.6	152 12.2	12.8	345 22.5	04.2	229 45.7	79	14 24.7	+149
6	206 21.9	221 37.3	− 7 14.1	221 23.6	− 7 16.8	167 14.6	+14 12.8	0 24.9	− 8 04.2	244 12.6	80	−14 09.8	+151
7	221 24.4	236 37.3	12.8	236 24.3	16.1	182 16.9	12.9	15 27.3	04.2	258 39.6	80	13 54.7	+151
8	236 26.8	251 37.3	11.6	251 25.0	15.3	197 19.3	12.9	30 29.7	04.2	273 06.6	82	13 39.6	+152
9	251 29.3	266 37.3	10.4	266 25.7	14.5	212 21.7	13.0	45 32.1	04.2	287 33.8	82	13 24.4	+153
10	266 31.8	281 37.3	09.1	281 26.4	13.8	227 24.0	13.0	60 34.4	04.3	302 01.0	84	13 09.1	+154
11	281 34.2	296 37.2	07.9	296 27.1	13.0	242 26.4	13.1	75 36.8	04.3	316 28.4	84	12 53.7	+154
12	296 36.7	311 37.2	− 7 06.7	311 27.7	− 7 12.2	257 28.8	+14 13.1	90 39.2	− 8 04.3	330 55.8	85	−12 38.3	+155
13	311 39.2	326 37.2	05.4	326 28.4	11.4	272 31.1	13.2	105 41.6	04.3	345 23.3	85	12 22.8	+156
14	326 41.6	341 37.2	04.2	341 29.1	10.7	287 33.5	13.2	120 44.0	04.3	359 50.8	87	12 07.2	+157
15	341 44.1	356 37.2	03.0	356 29.8	09.9	302 35.9	13.2	135 46.4	04.3	14 18.5	87	11 51.5	+157
16	356 46.6	11 37.2	01.7	11 30.5	09.1	317 38.2	13.3	150 48.7	04.4	28 46.2	88	11 35.8	+157
17	11 49.0	26 37.2	7 00.5	26 31.2	08.4	332 40.6	13.3	165 51.1	04.4	43 14.0	89	11 20.1	+159
18	26 51.5	41 37.2	− 6 59.3	41 31.9	− 7 07.6	347 42.9	+14 13.4	180 53.5	− 8 04.4	57 41.9	89	−11 04.2	+159
19	41 53.9	56 37.2	58.0	56 32.6	06.8	2 45.3	13.4	195 55.9	04.4	72 09.8	91	10 48.3	+159
20	56 56.4	71 37.2	56.8	71 33.3	06.0	17 47.7	13.5	210 58.3	04.4	86 37.9	91	10 32.4	+161
21	71 58.9	86 37.2	55.6	86 34.0	05.3	32 50.0	13.5	226 00.7	04.5	101 06.0	91	10 16.3	+160
22	87 01.3	101 37.2	54.3	101 34.7	04.5	47 52.4	13.6	241 03.1	04.5	115 34.1	93	10 00.3	+161
23	102 03.8	116 37.3	53.1	116 35.4	03.7	62 54.8	13.6	256 05.4	04.5	130 02.4	93	9 44.2	+162
18 0	117 06.3	131 37.3	− 6 51.9	131 36.1	− 7 03.0	77 57.1	+14 13.6	271 07.8	− 8 04.5	144 30.7	94	− 9 28.0	+162
1	132 08.7	146 37.3	50.6	146 36.7	02.2	92 59.5	13.7	286 10.2	04.5	158 59.1	94	9 11.8	+163
2	147 11.2	161 37.3	49.4	161 37.4	01.4	108 01.8	13.7	301 12.6	04.5	173 27.5	95	8 55.5	+163
3	162 13.7	176 37.3	48.2	176 38.1	7 00.6	123 04.2	13.8	316 15.0	04.6	187 56.0	96	8 39.2	+163
4	177 16.1	191 37.3	46.9	191 38.8	6 59.9	138 06.6	13.8	331 17.4	04.6	202 24.6	97	8 22.9	+164
5	192 18.6	206 37.3	45.7	206 39.5	59.1	153 08.9	13.9	346 19.8	04.6	216 53.3	97	8 06.5	+164
6	207 21.1	221 37.3	− 6 44.5	221 40.2	− 6 58.3	168 11.3	+14 13.9	1 22.1	− 8 04.6	231 22.0	98	− 7 50.1	+165
7	222 23.5	236 37.3	43.2	236 40.9	57.6	183 13.6	14.0	16 24.5	04.6	245 50.8	98	7 33.6	+165
8	237 26.0	251 37.3	42.0	251 41.6	56.8	198 16.0	14.0	31 26.9	04.7	260 19.6	99	7 17.1	+165
9	252 28.4	266 37.3	40.8	266 42.3	56.0	213 18.4	14.1	46 29.3	04.7	274 48.5	100	7 00.6	+166
10	267 30.9	281 37.3	39.5	281 43.0	55.2	228 20.7	14.1	61 31.7	04.7	289 17.5	100	6 44.0	+165
11	282 33.4	296 37.4	38.3	296 43.7	54.5	243 23.1	14.1	76 34.1	04.7	303 46.5	101	6 27.5	+167
12	297 35.8	311 37.4	− 6 37.0	311 44.4	− 6 53.7	258 25.4	+14 14.2	91 36.5	− 8 04.7	318 15.6	101	− 6 10.8	+166
13	312 38.3	326 37.4	35.8	326 45.1	52.9	273 27.8	14.2	106 38.8	04.7	332 44.7	102	5 54.2	+166
14	327 40.8	341 37.4	34.6	341 45.8	52.1	288 30.2	14.3	121 41.2	04.8	347 13.9	102	5 37.6	+167
15	342 43.2	356 37.4	33.3	356 46.5	51.4	303 32.5	14.3	136 43.6	04.8	1 43.1	103	5 20.9	+167
16	357 45.7	11 37.4	32.1	11 47.2	50.6	318 34.9	14.4	151 46.0	04.8	16 12.4	104	5 04.2	+167
17	12 48.2	26 37.4	30.9	26 47.9	49.8	333 37.2	14.4	166 48.4	04.8	30 41.8	104	4 47.5	+167
18	27 50.6	41 37.5	− 6 29.6	41 48.5	− 6 49.0	348 39.6	+14 14.5	181 50.8	− 8 04.8	45 11.2	104	− 4 30.8	+168
19	42 53.1	56 37.5	28.4	56 49.2	48.3	3 41.9	14.5	196 53.2	04.8	59 40.6	105	4 14.0	+167
20	57 55.6	71 37.5	27.1	71 49.9	47.5	18 44.3	14.6	211 55.6	04.9	74 10.1	106	3 57.3	+168
21	72 58.0	86 37.5	25.9	86 50.6	46.7	33 46.6	14.6	226 58.0	04.9	88 39.7	105	3 40.5	+167
22	88 00.5	101 37.5	24.7	101 51.3	46.0	48 49.0	14.7	242 00.3	04.9	103 09.2	107	3 23.8	+168
23	103 02.9	116 37.6	23.4	116 52.0	45.2	63 51.3	14.7	257 02.7	04.9	117 38.9	106	3 07.0	+168
24	118 05.4	131 37.6	− 6 22.2	131 52.7	− 6 44.4	78 53.7	+14 14.8	272 05.1	− 8 04.9	132 08.5	108	− 2 50.2	+168
code	−	0	+ 13	+ 7	+ 8	+ 23	+ 1	+ 24	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
16 0	177 35.2	−21 02.1
1	192 34.9	01.6
2	207 34.7	01.1
3	222 34.5	00.6
4	237 34.3	21 00.2
5	252 34.1	20 59.7
6	267 33.9	−20 59.2
7	282 33.6	58.8
8	297 33.4	58.3
9	312 33.2	57.8
10	327 33.0	57.3
11	342 32.8	56.9
12	357 32.6	−20 56.4
13	12 32.3	55.9
14	27 32.1	55.4
15	42 31.9	54.9
16	57 31.7	54.5
17	72 31.5	54.0
18	87 31.3	−20 53.5
19	102 31.1	53.0
20	117 30.9	52.5
21	132 30.6	52.1
22	147 30.4	51.6
23	162 30.2	51.1
17 0	177 30.0	−20 50.6
1	192 29.8	50.1
2	207 29.6	49.6
3	222 29.4	49.1
4	237 29.2	48.7
5	252 29.0	48.2
6	267 28.8	−20 47.7
7	282 28.5	47.2
8	297 28.3	46.7
9	312 28.1	46.2
10	327 27.9	45.7
11	342 27.7	45.2
12	357 27.5	−20 44.7
13	12 27.3	44.2
14	27 27.1	43.7
15	42 26.9	43.2
16	57 26.7	42.8
17	72 26.5	42.3
18	87 26.3	−20 41.8
19	102 26.1	41.3
20	117 25.9	40.8
21	132 25.7	40.3
22	147 25.5	39.8
23	162 25.3	39.3
18 0	177 25.1	−20 38.8
1	192 24.8	38.3
2	207 24.6	37.8
3	222 24.4	37.3
4	237 24.2	36.7
5	252 24.0	36.2
6	267 23.8	−20 35.7
7	282 23.6	35.2
8	297 23.4	34.7
9	312 23.2	34.2
10	327 23.0	33.7
11	342 22.8	33.2
12	357 22.6	−20 32.7
13	12 22.4	32.2
14	27 22.2	31.7
15	42 22.0	31.2
16	57 21.8	30.6
17	72 21.6	30.1
18	87 21.4	−20 29.6
19	102 21.2	29.1
20	117 21.0	28.6
21	132 20.8	28.1
22	147 20.7	27.6
23	162 20.5	27.0
24	177 20.3	−20 26.5
code	−	+ 5

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.4	−40 29.6
5	Achernar	336 00.2	−57 28.7
30	Acrux	174 00.1	−62 50.2
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.0	+56 12.4
34	Alkaid	153 34.4	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.5	+26 52.0
1	Alpheratz	358 30.7	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.3	−42 33.8
42	Antares	113 22.2	−26 19.8
37	Arcturus	146 37.1	+19 25.3
43	Atria	109 05.2	−68 56.6
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.2
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.4	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.7	+51 29.4
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.5	−56 50.9
29	Gienah	176 38.9	−17 16.9
35	Hadar	149 52.6	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.3	−34 24.6
40	Kochab	137 17.8	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.2	−36 08.4
24	Miapl'dus	221 48.8	−69 31.3
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.4
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.8	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.1	−60 38.5
44	Sabik	103 04.8	−15 40.2
3	Schedar	350 32.7	+56 17.2
45	Shaula	97 23.8	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.0	−10 55.1
23	Suhail	223 25.5	−43 14.5
49	Vega	81 10.1	+38 44.1
39	Zub'g'bi	137 55.8	−15 51.0

GMT	Equation of Time (App.—Mean) 16	17	18
h	m s	m s	m s
0	− 9 38.9	− 9 59.5	−10 19.4
6	− 9 44.1	−10 04.6	−10 24.3
12	− 9 49.3	−10 09.6	−10 29.1
18	− 9 54.4	−10 14.5	−10 33.8
24	− 9 59.5	−10 19.4	−10 38.6

Lat.	Sunrise	Twlt. begins	Moonrise 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	■	6 33	■	10 56	10 10	9 35
70	11 45	6 28	11 34	10 33	10 01	9 34
68	10 24	6 24	10 50	10 15	9 53	9 34
66	9 47	6 21	10 20	10 01	9 46	9 34
64	9 21	6 17	9 58	9 48	9 41	9 34
62	9 01	6 13	9 40	9 38	9 36	9 33
60	8 45	6 11	9 24	9 29	9 31	9 33
58	8 31	6 08	9 12	9 21	9 28	9 33
56	8 19	6 04	9 00	9 14	9 24	9 33
54	8 09	6 02	8 50	9 08	9 21	9 33
52	8 00	5 59	8 42	9 02	9 18	9 33
50	7 51	5 56	8 34	8 57	9 16	9 32
45	7 34	5 50	8 17	8 46	9 10	9 32
40	7 19	5 45	8 03	8 36	9 05	9 32
35	7 07	5 39	7 51	8 28	9 01	9 32
30	6 57	5 33	7 40	8 21	8 58	9 32
20	6 38	5 21	7 22	8 09	8 52	9 32
10	6 22	5 08	7 06	7 58	8 46	9 31
0	6 07	4 52	6 51	7 48	8 41	9 31
10	5 51	4 35	6 36	7 38	8 36	9 31
20	5 35	4 12	6 20	7 27	8 30	9 31
30	5 15	3 41	6 02	7 14	8 24	9 31
35	5 04	3 21	5 51	7 07	8 20	9 31
40	4 51	2 55	5 39	6 58	8 16	9 31
45	4 35	2 17	5 24	6 48	8 11	9 31
50	4 16	1 07	5 06	6 36	8 05	9 31
52	4 07	////	4 57	6 31	8 02	9 31
54	3 57	////	4 47	6 25	7 59	9 31
56	3 45	////	4 36	6 18	7 56	9 31
58	3 32	////	4 24	6 10	7 52	9 31
60 S	3 16	////	4 09	6 01	7 48	9 31

Lat.	Sunset	Twlt. ends	Moonset 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	■	17 48	■	17 36	20 13	22 37
70	12 36	17 54	14 59	17 56	20 19	22 32
68	13 57	17 59	15 42	18 12	20 24	22 29
66	14 34	18 02	16 10	18 25	20 28	22 25
64	15 00	18 06	16 31	18 36	20 32	22 23
62	15 20	18 09	16 48	18 45	20 34	22 20
60	15 36	18 12	17 02	18 52	20 37	22 18
58	15 50	18 15	17 14	18 59	20 39	22 16
56	16 02	18 18	17 24	19 05	20 41	22 15
54	16 12	18 20	17 33	19 10	20 43	22 13
52	16 21	18 22	17 41	19 14	20 44	22 12
50	16 29	18 25	17 49	19 19	20 46	22 11
45	16 47	18 31	18 04	19 28	20 49	22 08
40	17 01	18 36	18 17	19 35	20 52	22 06
35	17 13	18 42	18 27	19 42	20 54	22 04
30	17 24	18 48	18 36	19 47	20 56	22 02
20	17 43	19 00	18 52	19 57	20 59	22 00
10	17 59	19 13	19 06	20 06	21 02	21 57
0	18 14	19 28	19 19	20 13	21 05	21 55
10	18 29	19 45	19 31	20 21	21 08	21 52
20	18 46	20 08	19 45	20 29	21 10	21 50
30	19 05	20 38	20 00	20 38	21 13	21 47
35	19 16	20 58	20 08	20 44	21 15	21 45
40	19 29	21 24	20 18	20 49	21 17	21 43
45	19 45	22 01	20 30	20 56	21 19	21 41
50	20 03	23 07	20 44	21 04	21 22	21 38
52	20 13	////	20 50	21 08	21 23	21 37
54	20 23	////	20 57	21 12	21 25	21 36
56	20 34	////	21 05	21 17	21 26	21 35
58	20 47	////	21 14	21 22	21 28	21 33
60 S	21 03	////	21 24	21 27	21 30	21 31

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
16	13 05	15 14	15 15	18 53	6 02
17	14 01	15 14	15 14	18 49	5 58
18	14 53	15 14	15 13	18 45	5 55
19	15 43	15 14	15 12	18 42	5 51

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	16	17	18
°	′	′	′
0	20.5	20.5	20.1
4	20.5	20.5	20.1
8	20.5	20.5	20.1
12	20.4	20.4	20.0
16	20.3	20.3	20.0
20	20.2	20.2	19.9
24	20.1	20.1	19.8
28	20.0	20.0	19.7
32	19.8	19.8	19.5
36	19.7	19.7	19.4
40	19.5	19.5	19.2
44	19.3	19.3	19.0
48	19.1	19.1	18.8
52	18.9	18.9	18.6
56	18.7	18.7	18.4
60	18.4	18.4	18.2
64	18.2	18.2	18.0
68	17.9	17.9	17.8
72	17.7	17.7	17.5
76	17.4	17.4	17.3
80	17.2	17.2	17.0
84	16.9	16.9	16.8
88	16.7	16.7	16.6
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	16	17	18
°	′	′	′
0	12.7	12.7	12.9
4	12.7	12.7	13.0
8	12.8	12.8	13.0
12	12.8	12.8	13.0
16	12.9	12.9	13.1
20	13.0	13.0	13.2
24	13.1	13.1	13.3
28	13.2	13.2	13.4
32	13.4	13.4	13.5
36	13.5	13.5	13.7
40	13.7	13.7	13.9
44	13.9	13.9	14.0
48	14.1	14.1	14.2
52	14.3	14.3	14.4
56	14.5	14.5	14.6
60	14.8	14.8	14.8
64	15.0	15.0	15.1
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.1	16.1	16.0
84	16.3	16.3	16.3
88	16.5	16.5	16.5
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.3 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
19 0	118 05.4	131 37.6	− 6 22.2	131 52.7	− 6 44.4	78 53.7	+14 14.8	272 05.1	− 8 04.9	132 08.5	108	− 2 50.2	+168
1	133 07.9	146 37.6	20.9	146 53.4	43.6	93 56.1	14.8	287 07.5	04.9	146 38.3	107	2 33.4	+167
2	148 10.3	161 37.6	19.7	161 54.1	42.9	108 58.4	14.9	302 09.9	05.0	161 08.0	108	2 16.7	+168
3	163 12.8	176 37.7	·· 18.5	176 54.8	·· 42.1	124 00.8	·· 14.9	317 12.3	·· 05.0	175 37.8	108	· 1 59.9	+168
4	178 15.3	191 37.7	17.2	191 55.5	41.3	139 03.1	14.9	332 14.7	05.0	190 07.6	109	1 43.1	+168
5	193 17.7	206 37.7	16.0	206 56.2	40.5	154 05.5	15.0	347 17.1	05.0	204 37.5	109	1 26.3	+167
6	208 20.2	221 37.7	− 6 14.7	221 56.9	− 6 39.8	169 07.8	+14 15.0	2 19.5	− 8 05.0	219 07.4	109	− 1 09.6	+168
7	223 22.7	236 37.8	13.5	236 57.6	39.0	184 10.2	15.1	17 21.8	05.0	233 37.3	110	0 52.8	+167
8	238 25.1	251 37.8	12.3	251 58.3	38.2	199 12.5	15.1	32 24.2	05.1	248 07.3	110	0 36.1	+168
9	253 27.6	266 37.8	·· 11.0	266 59.0	·· 37.4	214 14.9	·· 15.2	47 26.6	·· 05.1	262 37.3	110	· 0 19.3	+167
10	268 30.1	281 37.8	09.8	281 59.7	36.7	229 17.2	15.2	62 29.0	05.1	277 07.3	111	− 0 02.6	+167
11	283 32.5	296 37.9	08.5	297 00.4	35.9	244 19.6	15.3	77 31.4	05.1	291 37.4	111	+ 0 14.1	+167
12	298 35.0	311 37.9	− 6 07.3	312 01.1	− 6 35.1	259 21.9	+14 15.3	92 33.8	− 8 05.1	306 07.5	111	+ 0 30.8	+167
13	313 37.4	326 37.9	06.1	327 01.8	34.3	274 24.3	15.4	107 36.2	05.1	320 37.6	111	0 47.5	+166
14	328 39.9	341 38.0	04.8	342 02.5	33.6	289 26.6	15.4	122 38.6	05.1	335 07.7	112	1 04.1	+167
15	343 42.4	356 38.0	·· 03.6	357 03.2	·· 32.8	304 29.0	·· 15.5	137 41.0	·· 05.2	349 37.9	112	· 1 20.8	+166
16	358 44.8	11 38.0	02.3	12 03.9	32.0	319 31.3	15.5	152 43.4	05.2	4 08.1	112	1 37.4	+166
17	13 47.3	26 38.1	6 01.1	27 04.6	31.2	334 33.7	15.6	167 45.8	05.2	18 38.3	112	1 54.0	+165
18	28 49.8	41 38.1	− 5 59.9	42 05.3	− 6 30.5	349 36.0	+14 15.6	182 48.2	− 8 05.2	33 08.5	113	+ 2 10.5	+166
19	43 52.2	56 38.1	58.6	57 06.0	29.7	4 38.4	15.7	197 50.5	05.2	47 38.8	112	2 27.1	+165
20	58 54.7	71 38.2	57.4	72 06.7	28.9	19 40.7	15.7	212 52.9	05.2	62 09.0	113	2 43.6	+164
21	73 57.2	86 38.2	·· 56.1	87 07.4	·· 28.1	34 43.0	·· 15.8	227 55.3	·· 05.3	76 39.3	113	· 3 00.0	+165
22	88 59.6	101 38.2	54.9	102 08.1	27.4	49 45.4	15.8	242 57.7	05.3	91 09.6	113	3 16.5	+164
23	104 02.1	116 38.3	53.6	117 08.7	26.6	64 47.7	15.9	258 00.1	05.3	105 39.9	113	3 32.9	+164
20 0	119 04.5	131 38.3	− 5 52.4	132 09.4	− 6 25.8	79 50.1	+14 15.9	273 02.5	− 8 05.3	120 10.2	114	+ 3 49.3	+163
1	134 07.0	146 38.4	51.2	147 10.1	25.0	94 52.4	16.0	288 04.9	05.3	134 40.6	113	4 05.6	+163
2	149 09.5	161 38.4	49.9	162 10.8	24.3	109 54.8	16.0	303 07.3	05.3	149 10.9	114	4 21.9	+163
3	164 11.9	176 38.4	·· 48.7	177 11.5	·· 23.5	124 57.1	·· 16.1	318 09.7	·· 05.3	163 41.3	113	· 4 38.2	+162
4	179 14.4	191 38.5	47.4	192 12.2	22.7	139 59.5	16.1	333 12.1	05.4	178 11.6	114	4 54.4	+162
5	194 16.9	206 38.5	46.2	207 12.9	21.9	155 01.8	16.2	348 14.5	05.4	192 42.0	114	5 10.6	+161
6	209 19.3	221 38.6	− 5 44.9	222 13.6	− 6 21.2	170 04.1	+14 16.2	3 16.9	− 8 05.4	207 12.4	113	+ 5 26.7	+161
7	224 21.8	236 38.6	43.7	237 14.3	20.4	185 06.5	16.3	18 19.3	05.4	221 42.7	114	5 42.8	+161
8	239 24.3	251 38.7	42.4	252 15.0	19.6	200 08.8	16.3	33 21.7	05.4	236 13.1	114	5 58.9	+160
9	254 26.7	266 38.7	·· 41.2	267 15.7	·· 18.8	215 11.2	·· 16.4	48 24.1	·· 05.4	250 43.5	114	· 6 14.9	+159
10	269 29.2	281 38.8	40.0	282 16.4	18.1	230 13.5	16.4	63 26.5	05.4	265 13.9	114	6 30.8	+159
11	284 31.7	296 38.8	38.7	297 17.1	17.3	245 15.9	16.5	78 28.8	05.5	279 44.3	113	6 46.7	+158
12	299 34.1	311 38.8	− 5 37.5	312 17.8	− 6 16.5	260 18.2	+14 16.5	93 31.2	− 8 05.5	294 14.6	114	+ 7 02.5	+158
13	314 36.6	326 38.9	36.2	327 18.5	15.7	275 20.5	16.6	108 33.6	05.5	308 45.0	114	7 18.3	+158
14	329 39.0	341 38.9	35.0	342 19.2	15.0	290 22.9	16.6	123 36.0	05.5	323 15.4	114	7 34.1	+157
15	344 41.5	356 39.0	·· 33.7	357 19.9	·· 14.2	305 25.2	·· 16.7	138 38.4	·· 05.5	337 45.8	113	· 7 49.8	+156
16	359 44.0	11 39.0	32.5	12 20.6	13.4	320 27.6	16.7	153 40.8	05.5	352 16.1	114	8 05.4	+156
17	14 46.4	26 39.1	31.2	27 21.3	12.6	335 29.9	16.8	168 43.2	05.5	6 46.5	113	8 21.0	+155
18	29 48.9	41 39.1	− 5 30.0	42 22.0	− 6 11.8	350 32.2	+14 16.9	183 45.6	− 8 05.6	21 16.8	114	+ 8 36.5	+154
19	44 51.4	56 39.2	28.8	57 22.7	11.1	5 34.6	16.9	198 48.0	05.6	35 47.2	113	8 51.9	+154
20	59 53.8	71 39.3	27.5	72 23.4	10.3	20 36.9	17.0	213 50.4	05.6	50 17.5	113	9 07.3	+153
21	74 56.3	86 39.3	·· 26.3	87 24.1	·· 09.5	35 39.3	·· 17.0	228 52.8	·· 05.6	64 47.8	113	· 9 22.6	+153
22	89 58.8	101 39.4	25.0	102 24.8	08.7	50 41.6	17.1	243 55.2	05.6	79 18.1	113	9 37.9	+152
23	105 01.2	116 39.4	23.8	117 25.5	08.0	65 43.9	17.1	258 57.6	05.6	93 48.4	113	9 53.1	+151
21 0	120 03.7	131 39.5	− 5 22.5	132 26.2	− 6 07.2	80 46.3	+14 17.2	274 00.0	− 8 05.6	108 18.7	112	+10 08.2	+151
1	135 06.1	146 39.5	21.3	147 26.9	06.4	95 48.6	17.2	289 02.4	05.6	122 48.9	113	10 23.3	+150
2	150 08.6	161 39.6	20.0	162 27.7	05.6	110 50.9	17.3	304 04.8	05.7	137 19.2	112	10 38.3	+149
3	165 11.1	176 39.6	·· 18.8	177 28.4	·· 04.8	125 53.3	·· 17.3	319 07.2	·· 05.7	151 49.4	112	·10 53.2	+148
4	180 13.5	191 39.7	17.5	192 29.1	04.1	140 55.6	17.4	334 09.6	05.7	166 19.6	112	11 08.0	+148
5	195 16.0	206 39.8	16.3	207 29.8	03.3	155 58.0	17.4	349 12.0	05.7	180 49.8	111	11 22.8	+147
6	210 18.5	221 39.8	− 5 15.0	222 30.5	− 6 02.5	171 00.3	+14 17.5	4 14.4	− 8 05.7	195 19.9	112	+11 37.5	+146
7	225 20.9	236 39.9	13.8	237 31.2	01.7	186 02.6	17.5	19 16.8	05.7	209 50.1	111	11 52.1	+145
8	240 23.4	251 39.9	12.6	252 31.9	01.0	201 05.0	17.6	34 19.2	05.7	224 20.2	111	12 06.6	+145
9	255 25.9	266 40.0	·· 11.3	267 32.6	· 6 00.2	216 07.3	·· 17.6	49 21.6	·· 05.8	238 50.3	111	·12 21.1	+144
10	270 28.3	281 40.1	10.1	282 33.3	5 59.4	231 09.6	17.7	64 24.0	05.8	253 20.4	110	12 35.5	+143
11	285 30.8	296 40.1	08.8	297 34.0	58.6	246 12.0	17.7	79 26.4	05.8	267 50.4	111	12 49.8	+142
12	300 33.3	311 40.2	− 5 07.6	312 34.7	− 5 57.8	261 14.3	+14 17.8	94 28.8	− 8 05.8	282 20.5	110	+13 04.0	+142
13	315 35.7	326 40.3	06.3	327 35.4	57.1	276 16.6	17.9	109 31.2	05.8	296 50.5	109	13 18.2	+140
14	330 38.2	341 40.3	05.1	342 36.1	56.3	291 19.0	17.9	124 33.6	05.8	311 20.4	110	13 32.2	+140
15	345 40.6	356 40.4	·· 03.8	357 36.8	·· 55.5	306 21.3	·· 18.0	139 36.0	·· 05.8	325 50.4	109	·13 46.2	+139
16	0 43.1	11 40.5	02.6	12 37.5	54.7	321 23.6	18.0	154 38.4	05.8	340 20.3	109	14 00.1	+138
17	15 45.6	26 40.5	01.3	27 38.2	54.0	336 26.0	18.1	169 40.8	05.9	354 50.2	108	14 13.9	+137
18	30 48.0	41 40.6	− 5 00.1	42 38.9	− 5 53.2	351 28.3	+14 18.1	184 43.2	− 8 05.9	9 20.0	108	+14 27.6	+136
19	45 50.5	56 40.7	4 58.8	57 39.6	52.4	6 30.6	18.2	199 45.6	05.9	23 49.8	108	14 41.2	+135
20	60 53.0	71 40.7	57.6	72 40.3	51.6	21 32.9	18.2	214 48.0	05.9	38 19.6	108	14 54.7	+135
21	75 55.4	86 40.8	·· 56.3	87 41.0	·· 50.8	36 35.3	·· 18.3	229 50.4	·· 05.9	52 49.4	107	·15 08.2	+133
22	90 57.9	101 40.9	55.1	102 41.7	50.1	51 37.6	18.3	244 52.8	05.9	67 19.1	107	15 21.5	+132
23	106 00.4	116 41.0	53.8	117 42.4	49.3	66 39.9	18.4	259 55.2	05.9	81 48.8	106	15 34.7	+132
24	121 02.8	131 41.0	− 4 52.6	132 43.1	− 5 48.5	81 42.3	+14 18.5	274 57.6	− 8 05.9	96 18.4	107	+15 47.9	+131
code	−	+ 1	+ 13	+ 7	+ 8	+ 23	+ 1	+ 24	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
19 0	177 20.3	−20 26.5
1	192 20.1	26.0
2	207 19.9	25.5
3	222 19.7	25.0
4	237 19.5	24.4
5	252 19.3	23.9
6	267 19.1	−20 23.4
7	282 18.9	22.9
8	297 18.7	22.4
9	312 18.5	21.8
10	327 18.3	21.3
11	342 18.1	20.8
12	357 17.9	−20 20.3
13	12 17.7	19.7
14	27 17.6	19.2
15	42 17.4	18.7
16	57 17.2	18.1
17	72 17.0	17.6
18	87 16.8	−20 17.1
19	102 16.6	16.6
20	117 16.4	16.0
21	132 16.2	15.5
22	147 16.0	15.0
23	162 15.8	14.4
20 0	177 15.7	−20 13.9
1	192 15.5	13.4
2	207 15.3	12.8
3	222 15.1	12.3
4	237 14.9	11.8
5	252 14.7	11.2
6	267 14.5	−20 10.7
7	282 14.4	10.1
8	297 14.2	09.6
9	312 14.0	09.1
10	327 13.8	08.5
11	342 13.6	08.0
12	357 13.4	−20 07.4
13	12 13.3	06.9
14	27 13.1	06.4
15	42 12.9	05.8
16	57 12.7	05.3
17	72 12.5	04.7
18	87 12.3	−20 04.2
19	102 12.2	03.6
20	117 12.0	03.1
21	132 11.8	02.5
22	147 11.6	02.0
23	162 11.4	01.4
21 0	177 11.3	−20 00.9
1	192 11.1	20 00.3
2	207 10.9	19 59.8
3	222 10.7	59.2
4	237 10.5	58.7
5	252 10.4	58.1
6	267 10.2	−19 57.6
7	282 10.0	57.0
8	297 09.8	56.5
9	312 09.7	55.9
10	327 09.5	55.4
11	342 09.3	54.8
12	357 09.1	−19 54.3
13	12 09.0	53.7
14	27 08.8	53.1
15	42 08.6	52.6
16	57 08.4	52.0
17	72 08.3	51.5
18	87 08.1	−19 50.9
19	102 07.9	50.3
20	117 07.7	49.8
21	132 07.6	49.2
22	147 07.4	48.7
23	162 07.2	48.1
24	177 07.0	−19 47.5
code	−	+ 5

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.5	−40 29.6
5	Achernar	336 00.2	−57 28.7
30	Acrux	174 00.1	−62 50.2
19	Adhara	255 47.8	−28 54.4
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.0	+56 12.4
34	Alkaid	153 34.3	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.5	+26 52.0
1	Alpheratz	358 30.7	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 22.1	−26 19.8
37	Arcturus	146 37.0	+19 25.3
43	Atria	109 05.2	−68 56.6
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.2
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.4	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.7	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.5	−56 50.9
29	Gienah	176 38.9	−17 17.0
35	Hadar	149 52.5	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.3	−34 24.6
40	Kochab	137 17.8	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.2	−36 08.4
24	Miapl'dus	221 48.8	−69 31.3
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.8	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.3	− 8 15.2
38	Rigil Kent.	140 54.1	−60 38.5
44	Sabik	103 04.8	−15 40.2
3	Schedar	350 32.7	+56 17.1
45	Shaula	97 23.8	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.0	−10 55.1
23	Suhail	223 25.5	−43 14.5
49	Vega	81 10.1	+38 44.1
39	Zub'g'bi	137 55.7	−15 51.0

GMT	Equation of Time (App.—Mean) 19	20	21
h	m s	m s	m s
0	−10 38.6	−10 57.0	−11 14.6
6	−10 43.2	−11 01.5	−11 18.9
12	−10 47.9	−11 05.9	−11 23.1
18	−10 52.4	−11 10.3	−11 27.3
24	−10 57.0	−11 14.6	−11 31.5

Lat.	Sunrise	Twlt. begins	Moonrise 19	20	21	22
N °	h m	h m	h m	h m	h m	h m
72	■	6 26	9 35	9 01	8 19	7 02
70	11 07	6 24	9 34	9 09	8 39	7 55
68	10 11	6 19	9 34	9 16	8 55	8 28
66	9 38	6 16	9 34	9 22	9 08	8 52
64	9 14	6 13	9 34	9 27	9 19	9 11
62	8 55	6 09	9 33	9 31	9 29	9 27
60	8 40	6 06	9 33	9 35	9 37	9 40
58	8 27	6 04	9 33	9 38	9 44	9 52
56	8 15	6 02	9 33	9 41	9 50	10 02
54	8 05	6 00	9 33	9 44	9 56	10 11
52	7 57	5 57	9 33	9 46	10 01	10 19
50	7 49	5 55	9 32	9 49	10 06	10 26
45	7 32	5 48	9 32	9 54	10 16	10 41
40	7 18	5 43	9 32	9 58	10 25	10 54
35	7 06	5 37	9 32	10 02	10 32	11 05
30	6 56	5 32	9 32	10 05	10 39	11 15
20	6 38	5 21	9 32	10 11	10 50	11 31
10	6 22	5 08	9 31	10 16	11 00	11 46
0	6 08	4 54	9 31	10 20	11 10	12 00
10	5 53	4 36	9 31	10 25	11 19	12 14
20	5 37	4 15	9 31	10 31	11 29	12 29
30	5 18	3 45	9 31	10 37	11 41	12 46
35	5 07	3 25	9 31	10 40	11 48	12 56
40	4 54	2 59	9 31	10 44	11 56	13 08
45	4 39	2 24	9 31	10 49	12 06	13 21
50	4 21	1 22	9 31	10 54	12 17	13 38
52	4 12	////	9 31	10 57	12 22	13 46
54	4 02	////	9 31	11 00	12 28	13 55
56	3 51	////	9 31	11 03	12 34	14 05
58	3 39	////	9 31	11 07	12 42	14 17
60	3 23	////	9 31	11 11	12 50	14 30
S						

Lat.	Sunset	Twlt. ends	Moonset 19	20	21	22
N °	h m	h m	h m	h m	h m	h m
72	■	17 57	22 37	25 04	1 04	4 08
70	13 16	18 02	22 32	24 46	0 46	3 16
68	14 12	18 05	22 29	24 33	0 33	2 45
66	14 45	18 09	22 25	24 21	0 21	2 22
64	15 09	18 12	22 23	24 12	0 12	2 04
62	15 28	18 15	22 20	24 04	0 04	1 49
60	15 43	18 17	22 18	23 58	25 37	1 37
58	15 56	18 19	22 16	23 51	25 26	1 26
56	16 07	18 21	22 15	23 46	25 17	1 17
54	16 17	18 24	22 13	23 42	25 09	1 09
52	16 26	18 27	22 12	23 37	25 02	1 02
50	16 34	18 29	22 11	23 34	24 56	0 56
45	16 51	18 34	22 08	23 25	24 42	0 42
40	17 05	18 40	22 06	23 19	24 30	0 30
35	17 17	18 45	22 04	23 13	24 21	0 21
30	17 27	18 50	22 02	23 08	24 12	0 12
20	17 45	19 02	22 00	22 59	23 58	24 57
10	18 00	19 14	21 57	22 51	23 45	24 40
0	18 15	19 28	21 55	22 44	23 33	24 24
10	18 29	19 45	21 52	22 36	23 22	24 09
20	18 45	20 06	21 50	22 29	23 09	23 52
30	19 04	20 36	21 47	22 20	22 55	23 33
35	19 15	20 55	21 45	22 15	22 47	23 22
40	19 27	21 20	21 43	22 09	22 37	23 09
45	19 42	21 55	21 41	22 03	22 27	22 54
50	20 00	22 55	21 38	21 55	22 14	22 36
52	20 09	////	21 37	21 52	22 07	22 27
54	20 19	////	21 36	21 48	22 01	22 17
56	20 30	////	21 35	21 43	21 53	22 07
58	20 42	////	21 33	21 38	21 45	21 54
60	20 57	////	21 31	21 33	21 36	21 40
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
19	15 43	15 14	15 12	18 42	5 51
20	16 32	15 13	15 11	18 38	5 47
21	17 21	15 13	15 10	18 34	5 43
22	18 12	15 13	15 08	18 30	5 39

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	19	20	21
°	′	′	′
0	19.5	18.6	17.7
4	19.5	18.6	17.7
8	19.5	18.6	17.7
12	19.4	18.5	17.7
16	19.3	18.5	17.6
20	19.3	18.4	17.6
24	19.2	18.4	17.5
28	19.1	18.3	17.5
32	19.0	18.2	17.4
36	18.8	18.1	17.4
40	18.7	18.0	17.3
44	18.5	17.9	17.2
48	18.4	17.7	17.1
52	18.2	17.6	17.0
56	18.0	17.5	16.9
60	17.9	17.3	16.8
64	17.7	17.2	16.7
68	17.5	17.0	16.6
72	17.2	16.9	16.5
76	17.0	16.7	16.4
80	16.8	16.5	16.3
84	16.6	16.4	16.1
88	16.4	16.2	16.0
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	19	20	21
°	′	′	′
0	13.3	13.8	14.3
4	13.3	13.8	14.3
8	13.3	13.8	14.3
12	13.4	13.9	14.4
16	13.4	13.9	14.4
20	13.5	14.0	14.4
24	13.6	14.0	14.5
28	13.7	14.1	14.5
32	13.8	14.2	14.6
36	14.0	14.3	14.7
40	14.1	14.4	14.8
44	14.2	14.5	14.8
48	14.4	14.7	14.9
52	14.6	14.8	15.0
56	14.8	14.9	15.1
60	14.9	15.1	15.2
64	15.1	15.2	15.3
68	15.3	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	16.0	15.9	15.8
84	16.2	16.0	15.9
88	16.3	16.2	16.0
90			

Subtract from table, back cover

918768°—52——2

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.3 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
22 h 0	121 02.8	131 41.0	− 4 52.6	132 43.1	− 5 48.5	81 42.3	+14 18.5	274 57.6	− 8 05.9	96 18.4	107	+15 47.9	+131
1	136 05.3	146 41.1	51.3	147 43.8	47.7	96 44.6	18.5	290 00.0	05.9	110 48.1	105	16 01.0	+129
2	151 07.8	161 41.2	50.1	162 44.5	47.0	111 46.9	18.6	305 02.4	06.0	125 17.6	106	16 13.9	+129
3	166 10.2	176 41.3	•• 48.8	177 45.2	•• 46.2	126 49.2	•• 18.6	320 04.8	•• 06.0	139 47.2	105	•16 26.8	+127
4	181 12.7	191 41.3	47.6	192 45.9	45.4	141 51.6	18.7	335 07.2	06.0	154 16.7	105	16 39.5	+127
5	196 15.1	206 41.4	46.3	207 46.6	44.6	156 53.9	18.7	350 09.6	06.0	168 46.2	104	16 52.2	+126
6	211 17.6	221 41.5	− 4 45.1	222 47.3	− 5 43.8	171 56.2	+14 18.8	5 12.0	− 8 06.0	183 15.6	104	+17 04.8	+124
7	226 20.1	236 41.6	43.8	237 48.0	43.1	186 58.6	18.8	20 14.4	06.0	197 45.0	103	17 17.2	+124
8	241 22.5	251 41.6	42.6	252 48.8	42.3	202 00.9	18.9	35 16.8	06.0	212 14.3	104	17 29.6	+122
9	256 25.0	266 41.7	•• 41.3	267 49.5	•• 41.5	217 03.2	•• 19.0	50 19.2	•• 06.0	226 43.7	102	•17 41.8	+122
10	271 27.5	281 41.8	40.1	282 50.2	40.7	232 05.5	19.0	65 21.6	06.0	241 12.9	103	17 54.0	+120
11	286 29.9	296 41.9	38.8	297 50.9	39.9	247 07.9	19.1	80 24.0	06.1	255 42.2	102	18 06.0	+119
12	301 32.4	311 42.0	− 4 37.6	312 51.6	− 5 39.2	262 10.2	+14 19.1	95 26.4	− 8 06.1	270 11.4	101	+18 17.9	+118
13	316 34.9	326 42.1	36.3	327 52.3	38.4	277 12.5	19.2	110 28.8	06.1	284 40.5	101	18 29.7	+117
14	331 37.3	341 42.1	35.1	342 53.0	37.6	292 14.8	19.2	125 31.2	06.1	299 09.6	101	18 41.4	+116
15	346 39.8	356 42.2	•• 33.8	357 53.7	•• 36.8	307 17.2	•• 19.3	140 33.6	•• 06.1	313 38.7	100	•18 53.0	+115
16	1 42.2	11 42.3	32.6	12 54.4	36.0	322 19.5	19.3	155 36.0	06.1	328 07.7	100	19 04.5	+114
17	16 44.7	26 42.4	31.3	27 55.1	35.3	337 21.8	19.4	170 38.4	06.1	342 36.7	100	19 15.9	+113
18	31 47.2	41 42.5	− 4 30.1	42 55.8	− 5 34.5	352 24.1	+14 19.5	185 40.8	− 8 06.1	357 05.7	99	+19 27.2	+111
19	46 49.6	56 42.6	28.8	57 56.5	33.7	7 26.5	19.5	200 43.2	06.1	11 34.6	98	19 38.3	+111
20	61 52.1	71 42.6	27.6	72 57.2	32.9	22 28.8	19.6	215 45.7	06.2	26 03.4	98	19 49.4	+109
21	76 54.6	86 42.7	•• 26.3	87 57.9	•• 32.1	37 31.1	•• 19.6	230 48.1	•• 06.2	40 32.2	98	•20 00.3	+108
22	91 57.0	101 42.8	25.1	102 58.6	31.4	52 33.4	19.7	245 50.5	06.2	55 01.0	98	20 11.1	+107
23	106 59.5	116 42.9	23.8	117 59.3	30.6	67 35.7	19.7	260 52.9	06.2	69 29.8	96	20 21.8	+105
23 0	122 02.0	131 43.0	− 4 22.6	133 00.0	− 5 29.8	82 38.1	+14 19.8	275 55.3	− 8 06.2	83 58.4	97	+20 32.3	+105
1	137 04.4	146 43.1	21.3	148 00.8	29.0	97 40.4	19.9	290 57.7	06.2	98 27.1	96	20 42.8	+103
2	152 06.9	161 43.2	20.1	163 01.5	28.2	112 42.7	19.9	306 00.1	06.2	112 55.7	95	20 53.1	+102
3	167 09.4	176 43.3	•• 18.8	178 02.2	•• 27.5	127 45.0	•• 20.0	321 02.5	•• 06.2	127 24.2	96	•21 03.3	+101
4	182 11.8	191 43.4	17.6	193 02.9	26.7	142 47.3	20.0	336 04.9	06.2	141 52.8	94	21 13.4	+ 99
5	197 14.3	206 43.5	16.3	208 03.6	25.9	157 49.7	20.1	351 07.3	06.2	156 21.2	95	21 23.3	+ 98
6	212 16.7	221 43.6	− 4 15.1	223 04.3	− 5 25.1	172 52.0	+14 20.2	6 09.7	− 8 06.3	170 49.7	93	+21 33.1	+ 97
7	227 19.2	236 43.7	13.8	238 05.0	24.3	187 54.3	20.2	21 12.1	06.3	185 18.0	94	21 42.8	+ 96
8	242 21.7	251 43.8	12.6	253 05.7	23.6	202 56.6	20.3	36 14.5	06.3	199 46.4	93	21 52.4	+ 95
9	257 24.1	266 43.9	•• 11.3	268 06.4	•• 22.8	217 58.9	•• 20.3	51 16.9	•• 06.3	214 14.7	92	•22 01.9	+ 93
10	272 26.6	281 44.0	10.1	283 07.1	22.0	233 01.3	20.4	66 19.3	06.3	228 42.9	93	22 11.2	+ 92
11	287 29.1	296 44.0	08.8	298 07.8	21.2	248 03.6	20.4	81 21.7	06.3	243 11.2	91	22 20.4	+ 91
12	302 31.5	311 44.1	− 4 07.6	313 08.5	− 5 20.4	263 05.9	+14 20.5	96 24.2	− 8 06.3	257 39.3	92	+22 29.5	+ 89
13	317 34.0	326 44.2	06.3	328 09.2	19.7	278 08.2	20.6	111 26.6	06.3	272 07.5	91	22 38.4	+ 88
14	332 36.5	341 44.4	05.0	343 10.0	18.9	293 10.5	20.6	126 29.0	06.3	286 35.6	90	22 47.2	+ 87
15	347 38.9	356 44.5	•• 03.8	358 10.7	•• 18.1	308 12.8	•• 20.7	141 31.4	•• 06.3	301 03.6	90	•22 55.9	+ 85
16	2 41.4	11 44.6	02.5	13 11.4	17.3	323 15.2	20.7	156 33.8	06.4	315 31.6	90	23 04.4	+ 85
17	17 43.9	26 44.7	01.3	28 12.1	16.5	338 17.5	20.8	171 36.2	06.4	329 59.6	89	23 12.9	+ 82
18	32 46.3	41 44.8	− 4 00.0	43 12.8	− 5 15.7	353 19.8	+14 20.9	186 38.6	− 8 06.4	344 27.5	89	+23 21.1	+ 82
19	47 48.8	56 44.9	3 58.8	58 13.5	15.0	8 22.1	20.9	201 41.0	06.4	358 55.4	89	23 29.3	+ 80
20	62 51.2	71 45.0	57.5	73 14.2	14.2	23 24.4	21.0	216 43.4	06.4	13 23.3	88	23 37.3	+ 79
21	77 53.7	86 45.1	•• 56.3	88 14.9	•• 13.4	38 26.7	•• 21.0	231 45.8	•• 06.4	27 51.1	87	•23 45.2	+ 77
22	92 56.2	101 45.2	55.0	103 15.6	12.6	53 29.1	21.1	246 48.2	06.4	42 18.8	88	23 52.9	+ 76
23	107 58.6	116 45.3	53.8	118 16.3	11.8	68 31.4	21.2	261 50.6	06.4	56 46.6	87	24 00.5	+ 75
24 0	123 01.1	131 45.4	− 3 52.5	133 17.0	− 5 11.1	83 33.7	+14 21.2	276 53.1	− 8 06.4	71 14.3	87	+24 08.0	+ 73
1	138 03.6	146 45.5	51.3	148 17.8	10.3	98 36.0	21.3	291 55.5	06.4	85 42.0	86	24 15.3	+ 72
2	153 06.0	161 45.6	50.0	163 18.5	09.5	113 38.3	21.3	306 57.9	06.4	100 09.6	86	24 22.5	+ 70
3	168 08.5	176 45.7	•• 48.8	178 19.2	•• 08.7	128 40.6	•• 21.4	322 00.3	•• 06.4	114 37.2	86	•24 29.5	+ 70
4	183 11.0	191 45.8	47.5	193 19.9	07.9	143 42.9	21.5	337 02.7	06.5	129 04.8	85	24 36.5	+ 67
5	198 13.4	206 45.9	46.3	208 20.6	07.2	158 45.2	21.5	352 05.1	06.5	143 32.3	85	24 43.2	+ 67
6	213 15.9	221 46.1	− 3 45.0	223 21.3	− 5 06.4	173 47.6	+14 21.6	7 07.5	− 8 06.5	157 59.8	85	+24 49.9	+ 64
7	228 18.4	236 46.2	43.8	238 22.0	05.6	188 49.9	21.6	22 09.9	06.5	172 27.3	84	24 56.3	+ 64
8	243 20.8	251 46.3	42.5	253 22.7	04.8	203 52.2	21.7	37 12.3	06.5	186 54.7	84	25 02.7	+ 62
9	258 23.3	266 46.4	•• 41.2	268 23.4	•• 04.0	218 54.5	•• 21.8	52 14.8	•• 06.5	201 22.1	84	•25 08.9	+ 60
10	273 25.7	281 46.5	40.0	283 24.1	03.2	233 56.8	21.8	67 17.2	06.5	215 49.5	83	25 14.9	+ 60
11	288 28.2	296 46.6	38.7	298 24.9	02.5	248 59.1	21.9	82 19.6	06.5	230 16.8	84	25 20.9	+ 57
12	303 30.7	311 46.7	− 3 37.5	313 25.6	− 5 01.7	264 01.4	+14 21.9	97 22.0	− 8 06.5	244 44.2	83	+25 26.6	+ 57
13	318 33.1	326 46.9	36.2	328 26.3	00.9	279 03.7	22.0	112 24.4	06.5	259 11.5	82	25 32.3	+ 54
14	333 35.6	341 47.0	35.0	343 27.0	5 00.1	294 06.0	22.1	127 26.8	06.5	273 38.7	83	25 37.7	+ 54
15	348 38.1	356 47.1	•• 33.7	358 27.7	• 4 59.3	309 08.3	•• 22.1	142 29.2	•• 06.5	288 06.0	82	•25 43.1	+ 52
16	3 40.5	11 47.2	32.5	13 28.4	58.5	324 10.6	22.2	157 31.6	06.6	302 33.2	82	25 48.3	+ 50
17	18 43.0	26 47.3	31.2	28 29.1	57.8	339 13.0	22.2	172 34.0	06.6	317 00.4	82	25 53.3	+ 49
18	33 45.5	41 47.5	− 3 30.0	43 29.8	− 4 57.0	354 15.3	+14 22.3	187 36.5	− 8 06.6	331 27.6	82	+25 58.2	+ 48
19	48 47.9	56 47.6	28.7	58 30.5	56.2	9 17.6	22.4	202 38.9	06.6	345 54.8	81	26 03.0	+ 46
20	63 50.4	71 47.7	27.5	73 31.3	55.4	24 19.9	22.4	217 41.3	06.6	0 21.9	81	26 07.6	+ 45
21	78 52.9	86 47.8	•• 26.2	88 32.0	•• 54.6	39 22.2	•• 22.5	232 43.7	•• 06.6	14 49.0	82	•26 12.1	+ 43
22	93 55.3	101 48.0	24.9	103 32.7	53.9	54 24.5	22.5	247 46.1	06.6	29 16.2	81	26 16.4	+ 41
23	108 57.8	116 48.1	23.7	118 33.4	53.1	69 26.8	22.6	262 48.5	06.6	43 43.3	80	26 20.5	+ 40
24	124 00.2	131 48.2	− 3 22.4	133 34.1	− 4 52.3	84 29.1	+14 22.7	277 50.9	− 8 06.6	58 10.3	81	+26 24.5	+ 39
code	−	+ 1	+ 13	+ 7	+ 7	+ 23	+ 1	+ 24	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
22 0	177 07.0	−19 47.5
1	192 06.9	47.0
2	207 06.7	46.4
3	222 06.5	45.8
4	237 06.4	45.3
5	252 06.2	44.7
6	267 06.0	−19 44.1
7	282 05.9	43.6
8	297 05.7	43.0
9	312 05.5	42.4
10	327 05.4	41.8
11	342 05.2	41.3
12	357 05.0	−19 40.7
13	12 04.8	40.1
14	27 04.7	39.6
15	42 04.5	39.0
16	57 04.3	38.4
17	72 04.2	37.8
18	87 04.0	−19 37.3
19	102 03.9	36.7
20	117 03.7	36.1
21	132 03.5	35.5
22	147 03.4	34.9
23	162 03.2	34.4
23 0	177 03.0	−19 33.8
1	192 02.9	33.2
2	207 02.7	32.6
3	222 02.5	32.0
4	237 02.4	31.5
5	252 02.2	30.9
6	267 02.1	−19 30.3
7	282 01.9	29.7
8	297 01.7	29.1
9	312 01.6	28.5
10	327 01.4	28.0
11	342 01.3	27.4
12	357 01.1	−19 26.8
13	12 00.9	26.2
14	27 00.8	25.6
15	42 00.6	25.0
16	57 00.5	24.4
17	72 00.3	23.8
18	87 00.2	−19 23.2
19	102 00.0	22.6
20	116 59.8	22.1
21	131 59.7	21.5
22	146 59.5	20.9
23	161 59.4	20.3
24 0	176 59.2	−19 19.7
1	191 59.1	19.1
2	206 58.9	18.5
3	221 58.8	17.9
4	236 58.6	17.3
5	251 58.4	16.7
6	266 58.3	−19 16.1
7	281 58.1	15.5
8	296 58.0	14.9
9	311 57.8	14.3
10	326 57.7	13.7
11	341 57.5	13.1
12	356 57.4	−19 12.5
13	11 57.2	11.9
14	26 57.1	11.3
15	41 56.9	10.7
16	56 56.8	10.1
17	71 56.6	09.5
18	86 56.5	−19 08.9
19	101 56.3	08.3
20	116 56.2	07.7
21	131 56.0	07.1
22	146 55.9	06.4
23	161 55.7	05.8
24	176 55.6	−19 05.2
code	−	+ 6

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.5	−40 29.6
5	Achernar	336 00.2	−57 28.7
30	Acrux	174 00.0	−62 50.2
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	167 00.0	+56 12.4
34	Alkaid	153 34.3	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.5	+26 52.0
1	Alpheratz	358 30.7	+28 50.1
51	Altair	62 52.8	+ 8 44.5
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 22.1	−26 19.9
37	Arcturus	146 37.0	+19 25.2
43	Atria	109 05.1	−68 56.6
22	Avior	234 36.1	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.2
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.6	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.3	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.6	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.5	−56 50.9
29	Gienah	176 38.8	−17 17.0
35	Hadar	149 52.5	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.2	−34 24.6
40	Kochab	137 17.7	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.1	−36 08.4
24	Miapl'dus	221 48.8	−69 31.3
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.8	−26 21.5
52	Peacock	54 31.0	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.8	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.3	− 8 15.3
38	Rigil Kent.	140 54.0	−60 38.5
44	Sabik	103 04.8	−15 40.2
3	Schedar	350 32.7	+56 17.1
45	Shaula	97 23.8	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.0	−10 55.1
23	Suhail	223 25.5	−43 14.5
49	Vega	81 10.0	+38 44.1
39	Zub'g'bi	137 55.7	−15 51.0

GMT	Equation of Time (App.—Mean) 22	23	24
h	m s	m s	m s
0	−11 31.5	−11 47.6	−12 02.8
6	−11 35.6	−11 51.4	−12 06.5
12	−11 39.6	−11 55.3	−12 10.2
18	−11 43.6	−11 59.1	−12 13.8
24	−11 47.6	−12 02.8	−12 17.3

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 22 h m	23 h m	24 h m	25 h m
72	■	6 19	7 02	□	□	□
70	10 42	6 17	7 55	□	□	□
68	9 57	6 14	8 28	7 22	□	□
66	9 28	6 11	8 52	8 26	□	□
64	9 06	6 08	9 11	9 01	8 42	□
62	8 49	6 06	9 27	9 27	9 29	9 41
60	8 34	6 03	9 40	9 47	10 00	10 25
58	8 22	6 01	9 52	10 04	10 23	10 55
56	8 11	5 58	10 02	10 18	10 42	11 17
54	8 02	5 57	10 11	10 30	10 57	11 36
52	7 53	5 54	10 19	10 41	11 11	11 51
50	7 46	5 53	10 26	10 51	11 23	12 05
45	7 29	5 47	10 41	11 11	11 48	12 33
40	7 16	5 42	10 54	11 28	12 08	12 55
35	7 05	5 37	11 05	11 42	12 25	13 13
30	6 55	5 32	11 15	11 55	12 39	13 29
20	6 38	5 21	11 31	12 16	13 04	13 56
10	6 23	5 09	11 46	12 34	13 25	14 19
0	6 08	4 55	12 00	12 52	13 45	14 40
10	5 54	4 39	12 14	13 09	14 06	15 02
20	5 39	4 17	12 29	13 28	14 27	15 25
30	5 21	3 49	12 46	13 50	14 52	15 52
35	5 10	3 29	12 56	14 03	15 07	16 08
40	4 58	3 05	13 08	14 18	15 23	16 26
45	4 44	2 31	13 21	14 36	15 46	16 49
50	4 26	1 35	13 38	14 58	16 12	17 17
52	4 18	0 48	13 46	15 08	16 25	17 31
54	4 08	////	13 55	15 21	16 40	17 48
56	3 58	////	14 05	15 34	16 57	18 07
58	3 46	////	14 17	15 51	17 18	18 31
60	3 31	////	14 30	16 11	17 45	19 03
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 22 h m	23 h m	24 h m	25 h m
72	■	18 07	4 08	□	□	□
70	13 43	18 11	3 16	□	□	□
68	14 27	18 13	2 45	5 38	□	□
66	14 57	18 16	2 22	4 36	□	□
64	15 19	18 19	2 04	4 02	6 12	□
62	15 36	18 20	1 49	3 37	5 25	7 07
60	15 51	18 23	1 37	3 17	4 55	6 23
58	16 03	18 25	1 26	3 01	4 33	5 54
56	16 14	18 27	1 17	2 48	4 14	5 31
54	16 23	18 29	1 09	2 36	3 59	5 13
52	16 31	18 31	1 02	2 26	3 45	4 57
50	16 39	18 33	0 56	2 16	3 34	4 44
45	16 55	18 38	0 42	1 57	3 10	4 16
40	17 08	18 42	0 30	1 41	2 50	3 55
35	17 20	18 48	0 21	1 28	2 34	3 37
30	17 29	18 52	0 12	1 17	2 20	3 21
20	17 46	19 03	24 57	0 57	1 57	2 55
10	18 01	19 14	24 40	0 40	1 36	2 33
0	18 16	19 29	24 24	0 24	1 17	2 12
10	18 30	19 45	24 09	0 09	0 58	1 51
20	18 45	20 06	23 52	24 38	0 38	1 28
30	19 03	20 34	23 33	24 15	0 15	1 02
35	19 13	20 52	23 22	24 01	0 01	0 47
40	19 25	21 17	23 09	23 46	24 29	0 29
45	19 40	21 50	22 54	23 27	24 08	0 08
50	19 57	22 44	22 36	23 04	23 41	24 28
52	20 05	23 27	22 27	22 53	23 27	24 14
54	20 15	////	22 17	22 40	23 12	23 58
56	20 25	////	22 07	22 26	22 55	23 39
58	20 37	////	21 54	22 09	22 33	23 14
60	20 51	////	21 40	21 49	22 06	22 42
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
22	18 12	15 13	15 08	18 30	5 39
23	19 05	15 13	15 07	18 27	5 35
24	19 59	15 13	15 06	18 23	5 32
25	20 53	15 13	15 05	18 19	5 28

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.2	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	22	23	24
°	′	′	′
0	16.7	15.8	15.0
4	16.7	15.8	15.0
8	16.7	15.8	15.0
12	16.7	15.8	15.1
16	16.7	15.8	15.1
20	16.6	15.8	15.1
24	16.6	15.8	15.1
28	16.6	15.8	15.1
32	16.5	15.8	15.1
36	16.5	15.8	15.1
40	16.5	15.8	15.1
44	16.4	15.7	15.2
48	16.4	15.7	15.2
52	16.3	15.7	15.2
56	16.3	15.7	15.2
60	16.2	15.7	15.3
64	16.2	15.7	15.3
68	16.1	15.7	15.3
72	16.0	15.7	15.3
76	16.0	15.6	15.4
80	15.9	15.6	15.4
84	15.9	15.6	15.4
88	15.8	15.6	15.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	22	23	24
°	′	′	′
0	14.9	15.4	15.8
4	14.9	15.4	15.8
8	14.9	15.4	15.8
12	14.9	15.4	15.8
16	14.9	15.4	15.8
20	15.0	15.4	15.8
24	15.0	15.4	15.8
28	15.0	15.4	15.8
32	15.0	15.4	15.8
36	15.1	15.4	15.8
40	15.1	15.5	15.7
44	15.2	15.5	15.7
48	15.2	15.5	15.7
52	15.3	15.5	15.7
56	15.3	15.5	15.7
60	15.4	15.5	15.6
64	15.4	15.5	15.6
68	15.5	15.5	15.6
72	15.5	15.6	15.5
76	15.6	15.6	15.5
80	15.7	15.6	15.5
84	15.7	15.6	15.5
88	15.8	15.6	15.4
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
25 0	124 00.2	131 48.2	− 3 22.4	133 34.1	− 4 52.3	84 29.1	+14 22.7	277 50.9	− 8 06.6	58 10.3	81	+26 24.5	+ 39
1	139 02.7	146 48.3	21.2	148 34.8	51.5	99 31.4	22.7	292 53.4	06.6	72 37.4	81	26 28.4	+ 37
2	154 05.2	161 48.5	19.9	163 35.5	50.7	114 33.7	22.8	307 55.8	06.6	87 04.5	80	26 32.1	+ 36
3	169 07.6	176 48.6	18.7	178 36.2	49.9	129 36.0	22.9	322 58.2	06.6	101 31.5	81	26 35.7	+ 34
4	184 10.1	191 48.7	17.4	193 37.0	49.2	144 38.3	22.9	338 00.6	06.6	115 58.6	80	26 39.1	+ 33
5	199 12.6	206 48.8	16.2	208 37.7	48.4	159 40.6	23.0	353 03.0	06.6	130 25.6	80	26 42.4	+ 31
6	214 15.0	221 49.0	− 3 14.9	223 38.4	− 4 47.6	174 42.9	+14 23.0	8 05.4	− 8 06.6	144 52.6	80	+26 45.5	+ 30
7	229 17.5	236 49.1	13.7	238 39.1	46.8	189 45.2	23.1	23 07.8	06.7	159 19.6	81	26 48.5	+ 28
8	244 20.0	251 49.2	12.4	253 39.8	46.0	204 47.5	23.2	38 10.3	06.7	173 46.7	80	26 51.3	+ 27
9	259 22.4	266 49.4	11.2	268 40.5	45.2	219 49.8	23.2	53 12.7	06.7	188 13.7	80	26 54.0	+ 25
10	274 24.9	281 49.5	09.9	283 41.2	44.5	234 52.1	23.3	68 15.1	06.7	202 40.7	80	26 56.5	+ 24
11	289 27.3	296 49.6	08.6	298 41.9	43.7	249 54.4	23.4	83 17.5	06.7	217 07.7	80	26 58.9	+ 22
12	304 29.8	311 49.8	− 3 07.4	313 42.7	− 4 42.9	264 56.7	+14 23.4	98 19.9	− 8 06.7	231 34.7	80	+27 01.1	+ 21
13	319 32.3	326 49.9	06.1	328 43.4	42.1	279 59.0	23.5	113 22.3	06.7	246 01.7	81	27 03.2	+ 20
14	334 34.7	341 50.0	04.9	343 44.1	41.3	295 01.3	23.6	128 24.8	06.7	260 28.8	80	27 05.2	+ 17
15	349 37.2	356 50.2	03.6	358 44.8	40.5	310 03.6	23.6	143 27.2	06.7	274 55.8	80	+27 06.9	+ 17
16	4 39.7	11 50.3	02.4	13 45.5	39.8	325 05.9	23.7	158 29.6	06.7	289 22.8	81	27 08.6	+ 15
17	19 42.1	26 50.4	3 01.1	28 46.2	39.0	340 08.2	23.7	173 32.0	06.7	303 49.9	80	27 10.1	+ 13
18	34 44.6	41 50.6	− 2 59.9	43 46.9	− 4 38.2	355 10.5	+14 23.8	188 34.4	− 8 06.7	318 16.9	81	+27 11.4	+ 12
19	49 47.1	56 50.7	58.6	58 47.7	37.4	10 12.8	23.9	203 36.8	06.7	332 44.0	81	27 12.6	+ 10
20	64 49.5	71 50.9	57.4	73 48.4	36.6	25 15.1	23.9	218 39.3	06.7	347 11.1	81	27 13.6	+ 9
21	79 52.0	86 51.0	56.1	88 49.1	35.8	40 17.4	24.0	233 41.7	06.7	1 38.2	81	+27 14.5	+ 7
22	94 54.5	101 51.1	54.8	103 49.8	35.1	55 19.7	24.1	248 44.1	06.7	16 05.3	81	27 15.2	+ 6
23	109 56.9	116 51.3	53.6	118 50.5	34.3	70 22.0	24.1	263 46.5	06.7	30 32.4	81	27 15.8	+ 5
26 0	124 59.4	131 51.4	− 2 52.3	133 51.2	− 4 33.5	85 24.3	+14 24.2	278 48.9	− 8 06.8	44 59.5	82	+27 16.3	+ 2
1	140 01.8	146 51.6	51.1	148 51.9	32.7	100 26.6	24.3	293 51.3	06.8	59 26.7	82	27 16.5	+ 2
2	155 04.3	161 51.7	49.8	163 52.7	31.9	115 28.9	24.3	308 53.8	06.8	73 53.9	82	27 16.7	0
3	170 06.8	176 51.9	48.6	178 53.4	31.1	130 31.2	24.4	323 56.2	06.8	88 21.1	82	−27 16.7	− 2
4	185 09.2	191 52.0	47.3	193 54.1	30.4	145 33.5	24.5	338 58.6	06.8	102 48.3	83	27 16.5	− 3
5	200 11.7	206 52.2	46.1	208 54.8	29.6	160 35.8	24.5	354 01.0	06.8	117 15.6	82	27 16.2	− 4
6	215 14.2	221 52.3	− 2 44.8	223 55.5	− 4 28.8	175 38.1	+14 24.6	9 03.4	− 8 06.8	131 42.8	83	+27 15.8	− 6
7	230 16.6	236 52.4	43.6	238 56.2	28.0	190 40.4	24.6	24 05.9	06.8	146 10.1	84	27 15.2	− 7
8	245 19.1	251 52.6	42.3	253 56.9	27.2	205 42.7	24.7	39 08.3	06.8	160 37.5	83	27 14.5	− 9
9	260 21.6	266 52.7	41.0	268 57.7	26.4	220 45.0	24.8	54 10.7	06.8	175 04.8	84	−27 13.6	− 10
10	275 24.0	281 52.9	39.8	283 58.4	25.7	235 47.3	24.8	69 13.1	06.8	189 32.2	85	27 12.6	− 12
11	290 26.5	296 53.0	38.5	298 59.1	24.9	250 49.6	24.9	84 15.5	06.8	203 59.7	84	27 11.4	− 13
12	305 29.0	311 53.2	− 2 37.3	313 59.8	− 4 24.1	265 51.9	+14 25.0	99 18.0	− 8 06.8	218 27.1	85	+27 10.1	− 15
13	320 31.4	326 53.4	36.0	329 00.5	23.3	280 54.2	25.0	114 20.4	06.8	232 54.6	86	27 08.6	− 16
14	335 33.9	341 53.5	34.8	344 01.2	22.5	295 56.5	25.1	129 22.8	06.8	247 22.2	86	27 07.0	− 17
15	350 36.3	356 53.7	33.5	359 02.0	21.7	310 58.8	25.2	144 25.2	06.8	261 49.8	86	−27 05.3	− 19
16	5 38.8	11 53.8	32.3	14 02.7	21.0	326 01.1	25.2	159 27.6	06.8	276 17.4	86	27 03.4	− 20
17	20 41.3	26 54.0	31.0	29 03.4	20.2	341 03.4	25.3	174 30.1	06.8	290 45.0	87	27 01.4	− 22
18	35 43.7	41 54.1	− 2 29.8	44 04.1	− 4 19.4	356 05.6	+14 25.4	189 32.5	− 8 06.8	305 12.7	88	+26 59.2	− 23
19	50 46.2	56 54.3	28.5	59 04.8	18.6	11 07.9	25.4	204 34.9	06.8	319 40.5	88	26 56.9	− 25
20	65 48.7	71 54.4	27.2	74 05.5	17.8	26 10.2	25.5	219 37.3	06.8	334 08.3	88	26 54.4	− 26
21	80 51.1	86 54.6	26.0	89 06.2	17.0	41 12.5	25.6	234 39.7	06.9	348 36.1	89	−26 51.8	− 27
22	95 53.6	101 54.8	24.7	104 07.0	16.2	56 14.8	25.6	249 42.2	06.9	3 04.0	89	26 49.1	− 29
23	110 56.1	116 54.9	23.5	119 07.7	15.5	71 17.1	25.7	264 44.6	06.9	17 31.9	90	26 46.2	− 30
27 0	125 58.5	131 55.1	− 2 22.2	134 08.4	− 4 14.7	86 19.4	+14 25.8	279 47.0	− 8 06.9	31 59.9	90	+26 43.2	− 31
1	141 01.0	146 55.2	21.0	149 09.1	13.9	101 21.7	25.8	294 49.4	06.9	46 27.9	91	26 40.1	− 33
2	156 03.5	161 55.4	19.7	164 09.8	13.1	116 24.0	25.9	309 51.8	06.9	60 56.0	92	26 36.8	− 34
3	171 05.9	176 55.6	18.5	179 10.6	12.3	131 26.3	26.0	324 54.3	06.9	75 24.2	91	−26 33.4	− 36
4	186 08.4	191 55.7	17.2	194 11.3	11.5	146 28.5	26.0	339 56.7	06.9	89 52.3	93	26 29.8	− 36
5	201 10.8	206 55.9	16.0	209 12.0	10.8	161 30.8	26.1	354 59.1	06.9	104 20.6	93	26 26.2	− 39
6	216 13.3	221 56.0	− 2 14.7	224 12.7	− 4 10.0	176 33.1	+14 26.2	10 01.5	− 8 06.9	118 48.9	93	+26 22.3	− 39
7	231 15.8	236 56.2	13.4	239 13.4	09.2	191 35.4	26.2	25 04.0	06.9	133 17.2	94	26 18.4	− 41
8	246 18.2	251 56.4	12.2	254 14.1	08.4	206 37.7	26.3	40 06.4	06.9	147 45.6	95	26 14.3	− 42
9	261 20.7	266 56.5	10.9	269 14.9	07.6	221 40.0	26.4	55 08.8	06.9	162 14.1	96	−26 10.1	− 44
10	276 23.2	281 56.7	09.7	284 15.6	06.8	236 42.3	26.4	70 11.2	06.9	176 42.7	95	26 05.7	− 44
11	291 25.6	296 56.9	08.4	299 16.3	06.0	251 44.6	26.5	85 13.7	06.9	191 11.2	97	26 01.3	− 46
12	306 28.1	311 57.1	− 2 07.2	314 17.0	− 4 05.3	266 46.8	+14 26.6	100 16.1	− 8 06.9	205 39.9	97	+25 56.7	− 48
13	321 30.6	326 57.2	05.9	329 17.7	04.5	281 49.1	26.6	115 18.5	06.9	220 08.6	98	25 51.9	− 48
14	336 33.0	341 57.4	04.7	344 18.4	03.7	296 51.4	26.7	130 20.9	06.9	234 37.4	98	25 47.1	− 50
15	351 35.5	356 57.6	03.4	359 19.2	02.9	311 53.7	26.8	145 23.4	06.9	249 06.2	99	−25 42.1	− 51
16	6 37.9	11 57.7	02.2	14 19.9	02.1	326 56.0	26.8	160 25.8	06.9	263 35.1	100	25 37.0	− 53
17	21 40.4	26 57.9	2 00.9	29 20.6	01.3	341 58.3	26.9	175 28.2	06.9	278 04.1	101	25 31.7	− 53
18	36 42.9	41 58.1	− 1 59.6	44 21.3	− 4 00.6	357 00.6	+14 27.0	190 30.6	− 8 06.9	292 33.2	101	+25 26.4	− 55
19	51 45.3	56 58.3	58.4	59 22.0	3 59.8	12 02.8	27.0	205 33.1	06.9	307 02.3	101	25 20.9	− 56
20	66 47.8	71 58.4	57.1	74 22.8	59.0	27 05.1	27.1	220 35.5	06.9	321 31.4	103	25 15.3	− 57
21	81 50.3	86 58.6	55.9	89 23.5	58.2	42 07.4	27.2	235 37.9	06.9	336 00.7	103	−25 09.6	− 59
22	96 52.7	101 58.8	54.6	104 24.2	57.4	57 09.7	27.3	250 40.3	06.9	350 30.0	104	25 03.7	− 60
23	111 55.2	116 59.0	53.4	119 24.9	56.6	72 12.0	27.3	265 42.8	06.9	4 59.4	104	24 57.7	− 60
24	126 57.7	131 59.1	− 1 52.1	134 25.6	− 3 55.8	87 14.3	+14 27.4	280 45.2	− 8 06.9	19 28.8	105	+24 51.7	− 62
code	−	+ 2	+ 13	+ 7	+ 8	+ 23	0	+ 24	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
25 0	176 55.6	−19 05.2
1	191 55.5	04.6
2	206 55.3	04.0
3	221 55.2	03.4
4	236 55.0	02.8
5	251 54.9	02.2
6	266 54.7	−19 01.6
7	281 54.6	00.9
8	296 54.4	19 00.3
9	311 54.3	−18 59.7
10	326 54.2	59.1
11	341 54.0	58.5
12	356 53.9	−18 57.9
13	11 53.7	57.2
14	26 53.6	56.6
15	41 53.4	56.0
16	56 53.3	55.4
17	71 53.2	54.8
18	86 53.0	−18 54.2
19	101 52.9	53.5
20	116 52.7	52.9
21	131 52.6	52.3
22	146 52.5	51.7
23	161 52.3	51.0
26 0	176 52.2	−18 50.4
1	191 52.1	49.8
2	206 51.9	49.2
3	221 51.8	48.5
4	236 51.6	47.9
5	251 51.5	47.3
6	266 51.4	−18 46.7
7	281 51.2	46.0
8	296 51.1	45.4
9	311 51.0	44.8
10	326 50.8	44.2
11	341 50.7	43.5
12	356 50.6	−18 42.9
13	11 50.4	42.3
14	26 50.3	41.6
15	41 50.2	41.0
16	56 50.0	40.4
17	71 49.9	39.7
18	86 49.8	−18 39.1
19	101 49.6	38.5
20	116 49.5	37.8
21	131 49.4	37.2
22	146 49.2	36.6
23	161 49.1	35.9
27 0	176 49.0	−18 35.3
1	191 48.9	34.6
2	206 48.7	34.0
3	221 48.6	33.4
4	236 48.5	32.7
5	251 48.3	32.1
6	266 48.2	−18 31.4
7	281 48.1	30.8
8	296 48.0	30.2
9	311 47.8	29.5
10	326 47.7	28.9
11	341 47.6	28.2
12	356 47.5	−18 27.6
13	11 47.3	26.9
14	26 47.2	26.3
15	41 47.1	25.6
16	56 47.0	25.0
17	71 46.8	24.3
18	86 46.7	−18 23.7
19	101 46.6	23.0
20	116 46.5	22.4
21	131 46.3	21.7
22	146 46.2	21.1
23	161 46.1	20.4
24	176 46.0	−18 19.8
code	−	+ 6

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.5	−40 29.6
5	Achernar	336 00.3	−57 28.7
30	Acrux	174 00.0	−62 50.2
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	166 59.9	+56 12.4
34	Alkaid	153 34.3	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.4	+26 51.9
1	Alpheratz	358 30.7	+28 50.0
51	Altair	62 52.7	+ 8 44.4
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 22.1	−26 19.9
37	Arcturus	146 37.0	+19 25.2
43	Atria	109 05.1	−68 56.6
22	Avior	234 36.1	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.1
17	Canopus	264 15.8	−52 40.2
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.7
28	Denebola	183 19.6	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.3	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.6	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.4	−56 50.9
29	Gienah	176 38.8	−17 17.0
35	Hadar	149 52.4	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.2	−34 24.6
40	Kochab	137 17.6	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.1	−36 08.4
24	Miapl'dus	221 48.8	−69 31.4
9	Mirfak	309 45.2	+49 42.1
50	Nunki	76 54.7	−26 21.5
52	Peacock	54 31.0	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.8	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 54.0	−60 38.5
44	Sabik	103 04.7	−15 40.2
3	Schedar	350 32.7	+56 17.1
45	Shaula	97 23.8	−37 04.3
18	Sirius	259 13.3	−16 39.0
33	Spica	159 19.0	−10 55.2
23	Suhail	223 25.5	−43 14.5
49	Vega	81 10.0	+38 44.1
39	Zub'g'bi	137 55.7	−15 51.0

GMT	Equation of Time (App.—Mean) 25	26	27
h	m s	m s	m s
0	−12 17.3	−12 31.0	−12 43.8
6	−12 20.8	−12 34.3	−12 46.9
12	−12 24.2	−12 37.5	−12 49.9
18	−12 27.6	−12 40.7	−12 52.9
24	−12 31.0	−12 43.8	−12 55.9

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 25 h m	26 h m	27 h m	28 h m
72	11 43	6 13	□	□	□	□
70	10 22	6 09	□	□	□	□
68	9 44	6 08	□	□	□	□
66	9 18	6 05	□	□	□	12 00
64	8 58	6 03	□	□	10 25	13 01
62	8 41	6 01	9 41	10 26	11 55	13 34
60	8 28	5 59	10 25	11 15	12 31	13 59
58	8 16	5 57	10 55	11 46	12 57	14 19
56	8 06	5 56	11 17	12 10	13 18	14 35
54	7 57	5 54	11 36	12 29	13 35	14 48
52	7 49	5 51	11 51	12 45	13 49	15 00
50	7 42	5 50	12 05	12 59	14 02	15 11
45	7 27	5 46	12 33	13 27	14 28	15 33
40	7 14	5 41	12 55	13 49	14 48	15 51
35	7 03	5 36	13 13	14 07	15 06	16 06
30	6 54	5 31	13 29	14 23	15 20	16 19
20	6 37	5 21	13 56	14 50	15 45	16 40
10	6 23	5 10	14 19	15 13	16 07	16 59
0	6 09	4 56	14 40	15 34	16 27	17 17
10	5 55	4 40	15 02	15 56	16 47	17 35
20	5 40	4 20	15 25	16 19	17 09	17 53
30	5 23	3 52	15 52	16 46	17 33	18 15
35	5 13	3 33	16 08	17 01	17 48	18 27
40	5 02	3 10	16 26	17 20	18 05	18 42
45	4 48	2 39	16 49	17 42	18 25	18 59
50	4 31	1 48	17 17	18 10	18 50	19 20
52	4 23	1 11	17 31	18 24	19 02	19 30
54	4 14	////	17 48	18 39	19 16	19 41
56	4 04	////	18 07	18 58	19 32	19 54
58	3 53	////	18 31	19 21	19 51	20 08
60	3 40	////	19 03	19 51	20 15	20 26
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 25 h m	26 h m	27 h m	28 h m
72	12 44	18 16	□	□	□	□
70	14 04	18 19	□	□	□	□
68	14 42	18 21	□	□	□	□
66	15 08	18 23	□	□	□	10 20
64	15 28	18 25	□	□	10 06	9 18
62	15 45	18 27	7 07	8 17	8 39	8 44
60	15 58	18 28	6 23	7 27	8 02	8 19
58	16 10	18 30	5 54	6 56	7 35	7 59
56	16 20	18 32	5 31	6 32	7 14	7 42
54	16 29	18 34	5 13	6 13	6 57	7 28
52	16 37	18 36	4 57	5 57	6 42	7 15
50	16 44	18 37	4 44	5 43	6 30	7 04
45	16 59	18 41	4 16	5 15	6 03	6 41
40	17 12	18 46	3 55	4 53	5 42	6 23
35	17 23	18 51	3 37	4 34	5 24	6 07
30	17 32	18 55	3 21	4 18	5 09	5 54
20	17 48	19 04	2 55	3 51	4 43	5 31
10	18 03	19 16	2 33	3 28	4 21	5 10
0	18 16	19 29	2 12	3 06	4 00	4 52
10	18 30	19 45	1 51	2 45	3 39	4 33
20	18 45	20 05	1 28	2 21	3 17	4 12
30	19 02	20 32	1 02	1 54	2 50	3 48
35	19 12	20 50	0 47	1 38	2 35	3 34
40	19 23	21 13	0 29	1 20	2 17	3 18
45	19 37	21 44	0 08	0 57	1 55	2 59
50	19 53	22 33	24 28	0 28	1 27	2 34
52	20 01	23 07	24 14	0 14	1 14	2 22
54	20 10	////	23 58	24 58	0 58	2 09
56	20 20	////	23 39	24 39	0 39	1 53
58	20 31	////	23 14	24 17	0 17	1 35
60	20 44	////	22 42	23 47	25 11	1 11
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
25	20 53	15 13	15 05	18 19	5 28
26	21 47	15 12	15 04	18 16	5 24
27	22 39	15 12	15 03	18 12	5 20
28	23 29	15 12	15 02	18 08	5 16

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.2	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	25	26	27
°	′	′	′
0	14.3	13.6	13.0
4	14.3	13.7	13.0
8	14.3	13.7	13.0
12	14.3	13.7	13.1
16	14.3	13.7	13.1
20	14.4	13.8	13.2
24	14.4	13.8	13.2
28	14.4	13.8	13.3
32	14.4	13.9	13.3
36	14.5	14.0	13.4
40	14.5	14.0	13.5
44	14.6	14.1	13.6
48	14.6	14.2	13.7
52	14.7	14.3	13.8
56	14.7	14.3	13.9
60	14.8	14.4	14.1
64	14.9	14.5	14.2
68	14.9	14.6	14.3
72	15.0	14.7	14.5
76	15.1	14.8	14.6
80	15.1	14.9	14.7
84	15.2	15.0	14.9
88	15.3	15.1	15.0
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	25	26	27
°	′	′	′
0	16.3	16.6	17.0
4	16.3	16.6	17.0
8	16.3	16.6	17.0
12	16.2	16.6	16.9
16	16.2	16.6	16.9
20	16.2	16.5	16.9
24	16.2	16.5	16.8
28	16.1	16.4	16.7
32	16.1	16.4	16.7
36	16.1	16.3	16.6
40	16.0	16.3	16.5
44	16.0	16.2	16.4
48	15.9	16.1	16.3
52	15.9	16.0	16.2
56	15.8	15.9	16.1
60	15.7	15.8	15.9
64	15.7	15.8	15.8
68	15.6	15.7	15.7
72	15.6	15.6	15.6
76	15.5	15.5	15.4
80	15.4	15.4	15.3
84	15.3	15.2	15.1
88	15.3	15.2	15.0
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.0 GHA	VENUS −4.0 Dec.	MARS 1.4 GHA	MARS 1.4 Dec.	JUPITER −2.0 GHA	JUPITER −2.0 Dec.	SATURN 0.8 GHA	SATURN 0.8 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
28 0	126 57.7	131 59.1	− 1 52.1	134 25.6	− 3 55.8	87 14.3	+14 27.4	280 45.2	− 8 06.9	19 28.8	105	+24 51.7	− 62
1	142 00.1	146 59.3	50.9	149 26.4	55.1	102 16.5	27.5	295 47.6	06.9	33 58.3	106	24 45.5	− 64
2	157 02.6	161 59.5	49.6	164 27.1	54.3	117 18.8	27.5	310 50.0	06.9	48 27.9	107	24 39.1	− 64
3	172 05.1	176 59.7	•• 48.4	179 27.8	•• 53.5	132 21.1	•• 27.6	325 52.5	•• 06.9	62 57.6	107	•24 32.7	− 66
4	187 07.5	191 59.9	47.1	194 28.5	52.7	147 23.4	27.7	340 54.9	06.9	77 27.3	108	24 26.1	− 66
5	202 10.0	207 00.0	45.9	209 29.2	51.9	162 25.7	27.7	355 57.3	06.9	91 57.1	109	24 19.5	− 68
6	217 12.4	222 00.2	− 1 44.6	224 30.0	− 3 51.1	177 27.9	+14 27.8	10 59.7	− 8 07.0	106 27.0	109	+24 12.7	− 69
7	232 14.9	237 00.4	43.3	239 30.7	50.3	192 30.2	27.9	26 02.2	07.0	120 56.9	111	24 05.8	− 70
8	247 17.4	252 00.6	42.1	254 31.4	49.6	207 32.5	27.9	41 04.6	07.0	135 27.0	111	23 58.8	− 71
9	262 19.8	267 00.8	•• 40.8	269 32.1	•• 48.8	222 34.8	•• 28.0	56 07.0	•• 07.0	149 57.1	111	•23 51.7	− 72
10	277 22.3	282 01.0	39.6	284 32.8	48.0	237 37.1	28.1	71 09.5	07.0	164 27.2	113	23 44.5	− 74
11	292 24.8	297 01.1	38.3	299 33.6	47.2	252 39.3	28.2	86 11.9	07.0	178 57.5	113	23 37.1	− 74
12	307 27.2	312 01.3	− 1 37.1	314 34.3	− 3 46.4	267 41.6	+14 28.2	101 14.3	− 8 07.0	193 27.8	114	+23 29.7	− 75
13	322 29.7	327 01.5	35.8	329 35.0	45.6	282 43.9	28.3	116 16.7	07.0	207 58.2	115	23 22.2	− 77
14	337 32.2	342 01.7	34.6	344 35.7	44.8	297 46.2	28.4	131 19.2	07.0	222 28.7	115	23 14.5	− 77
15	352 34.6	357 01.9	•• 33.3	359 36.4	•• 44.1	312 48.5	•• 28.4	146 21.6	•• 07.0	236 59.2	116	•23 06.8	− 79
16	7 37.1	12 02.1	32.1	14 37.2	43.3	327 50.7	28.5	161 24.0	07.0	251 29.8	117	22 58.9	− 80
17	22 39.6	27 02.3	30.8	29 37.9	42.5	342 53.0	28.6	176 26.5	07.0	266 00.5	118	22 50.9	− 80
18	37 42.0	42 02.5	− 1 29.6	44 38.6	− 3 41.7	357 55.3	+14 28.6	191 28.9	− 8 07.0	280 31.3	119	+22 42.9	− 82
19	52 44.5	57 02.7	28.3	59 39.3	40.9	12 57.6	28.7	206 31.3	07.0	295 02.2	119	22 34.7	− 82
20	67 46.9	72 02.9	27.0	74 40.0	40.1	27 59.8	28.8	221 33.7	07.0	309 33.1	120	22 26.5	− 84
21	82 49.4	87 03.1	•• 25.8	89 40.8	•• 39.3	43 02.1	•• 28.9	236 36.2	•• 07.0	324 04.1	121	•22 18.1	− 84
22	97 51.9	102 03.2	24.5	104 41.5	38.6	58 04.4	28.9	251 38.6	07.0	338 35.2	121	22 09.7	− 86
23	112 54.3	117 03.4	23.3	119 42.2	37.8	73 06.7	29.0	266 41.0	07.0	353 06.3	123	22 01.1	− 86
29 0	127 56.8	132 03.6	− 1 22.0	134 42.9	− 3 37.0	88 08.9	+14 29.1	281 43.5	− 8 07.0	7 37.6	123	+21 52.5	− 88
1	142 59.3	147 03.8	20.8	149 43.6	36.2	103 11.2	29.1	296 45.9	07.0	22 08.9	123	21 43.7	− 88
2	158 01.7	162 04.0	19.5	164 44.4	35.4	118 13.5	29.2	311 48.3	07.0	36 40.2	125	21 34.9	− 90
3	173 04.2	177 04.2	•• 18.3	179 45.1	•• 34.6	133 15.8	•• 29.3	326 50.8	•• 07.0	51 11.7	125	•21 25.9	− 90
4	188 06.7	192 04.4	17.0	194 45.8	33.8	148 18.0	29.4	341 53.2	07.0	65 43.2	126	21 16.9	− 91
5	203 09.1	207 04.6	15.8	209 46.5	33.1	163 20.3	29.4	356 55.6	07.0	80 14.8	127	21 07.8	− 92
6	218 11.6	222 04.8	− 1 14.5	224 47.3	− 3 32.3	178 22.6	+14 29.5	11 58.1	− 8 07.0	94 46.5	128	+20 58.6	− 93
7	233 14.1	237 05.0	13.3	239 48.0	31.5	193 24.9	29.6	27 00.5	07.0	109 18.3	128	20 49.3	− 93
8	248 16.5	252 05.2	12.0	254 48.7	30.7	208 27.1	29.6	42 02.9	07.0	123 50.1	129	20 40.0	− 95
9	263 19.0	267 05.4	•• 10.8	269 49.4	•• 29.9	223 29.4	•• 29.7	57 05.3	•• 07.0	138 22.0	130	•20 30.5	− 96
10	278 21.4	282 05.6	09.5	284 50.1	29.1	238 31.7	29.8	72 07.8	07.0	152 54.0	131	20 20.9	− 96
11	293 23.9	297 05.8	08.3	299 50.9	28.3	253 33.9	29.9	87 10.2	07.0	167 26.1	131	20 11.3	− 97
12	308 26.4	312 06.0	− 1 07.0	314 51.6	− 3 27.6	268 36.2	+14 29.9	102 12.6	− 8 07.0	181 58.2	132	+20 01.6	− 98
13	323 28.8	327 06.3	05.8	329 52.3	26.8	283 38.5	30.0	117 15.1	07.0	196 30.4	133	19 51.8	− 99
14	338 31.3	342 06.5	04.5	344 53.0	26.0	298 40.8	30.1	132 17.5	07.0	211 02.7	134	19 41.9	− 99
15	353 33.8	357 06.7	•• 03.2	359 53.8	•• 25.2	313 43.0	•• 30.1	147 19.9	•• 07.0	225 35.1	134	•19 32.0	−101
16	8 36.2	12 06.9	02.0	14 54.5	24.4	328 45.3	30.2	162 22.4	07.0	240 07.5	135	19 21.9	−101
17	23 38.7	27 07.1	1 00.7	29 55.2	23.6	343 47.6	30.3	177 24.8	07.0	254 40.0	136	19 11.8	−102
18	38 41.2	42 07.3	− 0 59.5	44 55.9	− 3 22.8	358 49.8	+14 30.4	192 27.2	− 8 07.0	269 12.6	136	+19 01.6	−102
19	53 43.6	57 07.5	58.2	59 56.6	22.1	13 52.1	30.4	207 29.7	07.0	283 45.2	137	18 51.4	−104
20	68 46.1	72 07.7	57.0	74 57.4	21.3	28 54.4	30.5	222 32.1	07.0	298 17.9	138	18 41.0	−104
21	83 48.6	87 07.9	•• 55.7	89 58.1	•• 20.5	43 56.6	•• 30.6	237 34.5	•• 07.0	312 50.7	139	•18 30.6	−105
22	98 51.0	102 08.1	54.5	104 58.8	19.7	58 58.9	30.7	252 37.0	07.0	327 23.6	139	18 20.1	−106
23	113 53.5	117 08.3	53.2	119 59.5	18.9	74 01.2	30.7	267 39.4	07.0	341 56.5	140	18 09.5	−106
30 0	128 55.9	132 08.6	− 0 52.0	135 00.3	− 3 18.1	89 03.5	+14 30.8	282 41.8	− 8 07.0	356 29.5	141	+17 58.9	−107
1	143 58.4	147 08.8	50.7	150 01.0	17.3	104 05.7	30.9	297 44.3	07.0	11 02.6	141	17 48.2	−108
2	159 00.9	162 09.0	49.5	165 01.7	16.6	119 08.0	30.9	312 46.7	07.0	25 35.7	142	17 37.4	−108
3	174 03.3	177 09.2	•• 48.2	180 02.4	•• 15.8	134 10.3	•• 31.0	327 49.2	•• 07.0	40 08.9	143	•17 26.6	−109
4	189 05.8	192 09.4	47.0	195 03.2	15.0	149 12.5	31.1	342 51.6	07.0	54 42.2	143	17 15.7	−110
5	204 08.3	207 09.6	45.7	210 03.9	14.2	164 14.8	31.2	357 54.0	07.0	69 15.5	144	17 04.7	−111
6	219 10.7	222 09.9	− 0 44.5	225 04.6	− 3 13.4	179 17.0	+14 31.2	12 56.5	− 8 07.0	83 48.9	145	+16 53.6	−111
7	234 13.2	237 10.1	43.2	240 05.3	12.6	194 19.3	31.3	27 58.9	07.0	98 22.4	145	16 42.5	−112
8	249 15.7	252 10.3	42.0	255 06.1	11.8	209 21.6	31.4	43 01.3	07.0	112 55.9	146	16 31.3	−112
9	264 18.1	267 10.5	•• 40.7	270 06.8	•• 11.0	224 23.8	•• 31.5	58 03.8	•• 07.0	127 29.5	147	•16 20.1	−113
10	279 20.6	282 10.7	39.5	285 07.5	10.3	239 26.1	31.5	73 06.2	07.0	142 03.2	147	16 08.8	−113
11	294 23.0	297 11.0	38.2	300 08.2	09.5	254 28.4	31.6	88 08.6	07.0	156 36.9	148	15 57.5	−115
12	309 25.5	312 11.2	− 0 37.0	315 09.0	− 3 08.7	269 30.6	+14 31.7	103 11.1	− 8 07.0	171 10.7	148	+15 46.0	−114
13	324 28.0	327 11.4	35.7	330 09.7	07.9	284 32.9	31.8	118 13.5	07.0	185 44.5	150	15 34.6	−116
14	339 30.4	342 11.6	34.5	345 10.4	07.1	299 35.2	31.8	133 15.9	07.0	200 18.5	149	15 23.0	−116
15	354 32.9	357 11.9	•• 33.2	0 11.1	•• 06.3	314 37.4	•• 31.9	148 18.4	•• 07.0	214 52.4	151	•15 11.4	−116
16	9 35.4	12 12.1	32.0	15 11.9	05.5	329 39.7	32.0	163 20.8	07.0	229 26.5	151	14 59.8	−117
17	24 37.8	27 12.3	30.7	30 12.6	04.8	344 42.0	32.1	178 23.3	06.9	244 00.6	151	14 48.1	−118
18	39 40.3	42 12.5	− 0 29.5	45 13.3	− 3 04.0	359 44.2	+14 32.1	193 25.7	− 8 06.9	258 34.7	152	+14 36.3	−118
19	54 42.8	57 12.8	28.2	60 14.0	03.2	14 46.5	32.2	208 28.1	06.9	273 08.9	153	14 24.5	−119
20	69 45.2	72 13.0	27.0	75 14.8	02.4	29 48.7	32.3	223 30.6	06.9	287 43.2	153	14 12.6	−119
21	84 47.7	87 13.2	•• 25.7	90 15.5	•• 01.6	44 51.0	•• 32.4	238 33.0	•• 06.9	302 17.5	154	•14 00.7	−120
22	99 50.2	102 13.5	24.5	105 16.2	00.8	59 53.3	32.4	253 35.5	06.9	316 51.9	154	13 48.7	−120
23	114 52.6	117 13.7	23.2	120 16.9	3 00.0	74 55.5	32.5	268 37.9	06.9	331 26.3	155	13 36.7	−120
24	129 55.1	132 13.9	− 0 22.0	135 17.7	− 2 59.2	89 57.8	+14 32.6	283 40.3	− 8 06.9	346 00.8	156	+13 24.7	−122
code	−	+ 3	+ 12	+ 7	+ 8	+ 23	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.
28 h 0	176 46.0	−18 19.8
1	191 45.9	19.1
2	206 45.7	18.5
3	221 45.6	17.8
4	236 45.5	17.2
5	251 45.4	16.5
6	266 45.3	−18 15.9
7	281 45.1	15.2
8	296 45.0	14.6
9	311 44.9	13.9
10	326 44.8	13.2
11	341 44.7	12.6
12	356 44.6	−18 11.9
13	11 44.4	11.3
14	26 44.3	10.6
15	41 44.2	10.0
16	56 44.1	09.3
17	71 44.0	08.6
18	86 43.9	−18 08.0
19	101 43.7	07.3
20	116 43.6	06.6
21	131 43.5	06.0
22	146 43.4	05.3
23	161 43.3	04.7
29 0	176 43.2	−18 04.0
1	191 43.1	03.3
2	206 43.0	02.7
3	221 42.8	02.0
4	236 42.7	01.3
5	251 42.6	00.7
6	266 42.5	−18 00.0
7	281 42.4	17 59.3
8	296 42.3	58.6
9	311 42.2	58.0
10	326 42.1	57.3
11	341 42.0	56.6
12	356 41.9	−17 56.0
13	11 41.7	55.3
14	26 41.6	54.6
15	41 41.5	53.9
16	56 41.4	53.3
17	71 41.3	52.6
18	86 41.2	−17 51.9
19	101 41.1	51.2
20	116 41.0	50.6
21	131 40.9	49.9
22	146 40.8	49.2
23	161 40.7	48.5
30 0	176 40.6	−17 47.9
1	191 40.5	47.2
2	206 40.4	46.5
3	221 40.3	45.8
4	236 40.2	45.1
5	251 40.1	44.4
6	266 40.0	−17 43.8
7	281 39.9	43.1
8	296 39.8	42.4
9	311 39.7	41.7
10	326 39.6	41.0
11	341 39.5	40.3
12	356 39.4	−17 39.7
13	11 39.3	39.0
14	26 39.2	38.3
15	41 39.1	37.6
16	56 39.0	36.9
17	71 38.9	36.2
18	86 38.8	−17 35.5
19	101 38.7	34.9
20	116 38.6	34.2
21	131 38.5	33.5
22	146 38.4	32.8
23	161 38.3	32.1
24	176 38.2	−17 31.4
code	−	+ 7

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.5	−40 29.7
5	Achernar	336 00.3	−57 28.7
30	Acrux	173 59.9	−62 50.3
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	166 59.9	+56 12.4
34	Alkaid	153 34.2	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.4	+26 51.9
1	Alpheratz	358 30.7	+28 50.0
51	Altair	62 52.7	+ 8 44.4
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 22.1	−26 19.9
37	Arcturus	146 37.0	+19 25.2
43	Atria	109 05.0	−68 56.6
22	Avior	234 36.1	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 15.8	−52 40.3
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.6
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.3	+62 00.0
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 07.6	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.4	−56 50.9
29	Gienah	176 38.8	−17 17.0
35	Hadar	149 52.4	−60 08.7
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.2	−34 24.6
40	Kochab	137 17.6	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.1	−36 08.4
24	Miapl'dus	221 48.8	−69 31.4
9	Mirfak	309 45.3	+49 42.1
50	Nunki	76 54.7	−26 21.5
52	Peacock	54 31.0	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.7	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.9	−60 38.5
44	Sabik	103 04.7	−15 40.2
3	Schedar	350 32.7	+56 17.1
45	Shaula	97 23.7	−37 04.3
18	Sirius	259 13.3	−16 39.1
33	Spica	159 18.9	−10 55.2
23	Suhail	223 25.5	−43 14.6
49	Vega	81 10.0	+38 44.1
39	Zub'g'bi	137 55.7	−15 51.0

GMT	Equation of Time (App.—Mean) 28	29	30
h	m s	m s	m s
0	−12 55.9	−13 07.1	−13 17.5
6	−12 58.7	−13 09.7	−13 19.9
12	−13 01.6	−13 12.4	−13 22.4
18	−13 04.3	−13 14.9	−13 24.7
24	−13 07.1	−13 17.5	−13 27.1

Lat.	Sunrise	Twlt. begins	Moonrise 28	29	30	31
N °	h m	h m	h m	h m	h m	h m
72	10 57	6 03	▭	▭	14 56	17 18
70	10 04	6 01	▭	12 17	15 32	17 34
68	9 31	6 01	▭	13 48	15 57	17 46
66	9 08	5 59	12 00	14 25	16 17	17 57
64	8 49	5 57	13 01	14 52	16 32	18 05
62	8 34	5 56	13 34	15 12	16 45	18 13
60	8 21	5 55	13 59	15 29	16 56	18 19
58	8 10	5 53	14 19	15 43	17 05	18 25
56	8 01	5 52	14 35	15 55	17 13	18 30
54	7 53	5 50	14 48	16 05	17 20	18 34
52	7 45	5 48	15 00	16 14	17 27	18 38
50	7 38	5 47	15 11	16 22	17 33	18 42
45	7 24	5 43	15 33	16 40	17 45	18 49
40	7 12	5 38	15 51	16 54	17 56	18 56
35	7 01	5 35	16 06	17 06	18 04	19 01
30	6 52	5 31	16 19	17 16	18 12	19 06
20	6 37	5 21	16 40	17 34	18 25	19 15
10	6 23	5 10	16 59	17 49	18 37	19 22
0	6 10	4 58	17 17	18 04	18 48	19 29
10	5 57	4 42	17 35	18 18	18 58	19 36
20	5 42	4 22	17 53	18 33	19 10	19 43
30	5 26	3 55	18 15	18 51	19 22	19 51
35	5 16	3 37	18 27	19 01	19 30	19 56
40	5 05	3 15	18 42	19 12	19 38	20 01
45	4 52	2 45	18 59	19 26	19 48	20 07
50	4 36	1 58	19 20	19 42	20 00	20 15
52	4 29	1 28	19 30	19 50	20 06	20 18
54	4 21	////	19 41	19 59	20 12	20 22
56	4 11	////	19 54	20 08	20 18	20 26
58	4 00	////	20 08	20 19	20 26	20 31
60	3 48	////	20 26	20 31	20 34	20 36
S						

Lat.	Sunset	Twlt. ends	Moonset 28	29	30	31
N °	h m	h m	h m	h m	h m	h m
72	13 30	18 27	▭	▭	10 39	9 44
70	14 24	18 28	▭	11 41	10 01	9 26
68	14 56	18 29	▭	10 12	9 34	9 11
66	15 20	18 31	10 20	9 33	9 13	8 59
64	15 38	18 32	9 18	9 05	8 57	8 49
62	15 53	18 33	8 44	8 44	8 43	8 41
60	16 06	18 34	8 19	8 27	8 31	8 33
58	16 17	18 36	7 59	8 12	8 21	8 27
56	16 26	18 37	7 42	8 00	8 12	8 21
54	16 35	18 39	7 28	7 49	8 04	8 16
52	16 42	18 40	7 15	7 39	7 57	8 11
50	16 49	18 41	7 04	7 30	7 50	8 06
45	17 03	18 45	6 41	7 12	7 36	7 57
40	17 15	18 48	6 23	6 57	7 25	7 49
35	17 26	18 53	6 07	6 44	7 15	7 42
30	17 35	18 57	5 54	6 32	7 06	7 36
20	17 50	19 06	5 31	6 13	6 51	7 26
10	18 04	19 17	5 10	5 56	6 38	7 16
0	18 17	19 29	4 52	5 40	6 25	7 08
10	18 30	19 44	4 33	5 24	6 13	6 59
20	18 44	20 04	4 12	5 06	5 59	6 49
30	19 00	20 29	3 48	4 47	5 43	6 38
35	19 10	20 47	3 34	4 35	5 34	6 32
40	19 21	21 09	3 18	4 21	5 24	6 25
45	19 33	21 38	2 59	4 05	5 11	6 16
50	19 49	22 23	2 34	3 45	4 56	6 06
52	19 57	22 52	2 22	3 36	4 49	6 01
54	20 05	23 46	2 09	3 25	4 41	5 56
56	20 14	////	1 53	3 13	4 32	5 50
58	20 25	////	1 35	2 59	4 22	5 44
60	20 37	////	1 11	2 42	4 11	5 36
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
28	23 29	15 12	15 02	18 08	5 16
29	24 15	15 12	15 00	18 05	5 12
30	0 15	15 11	14 59	18 01	5 08
31	0 58	15 11	14 58	17 58	5 05

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.2	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	28	29	30
°	′	′	′
0	12.6	12.2	12.0
4	12.6	12.3	12.0
8	12.7	12.3	12.0
12	12.7	12.3	12.1
16	12.7	12.4	12.1
20	12.8	12.4	12.2
24	12.9	12.5	12.3
28	12.9	12.6	12.4
32	13.0	12.7	12.5
36	13.1	12.8	12.6
40	13.2	12.9	12.7
44	13.3	13.0	12.8
48	13.4	13.2	13.0
52	13.6	13.3	13.1
56	13.7	13.5	13.3
60	13.8	13.6	13.5
64	14.0	13.8	13.6
68	14.1	14.0	13.8
72	14.3	14.1	14.0
76	14.4	14.3	14.2
80	14.6	14.5	14.4
84	14.8	14.7	14.6
88	14.9	14.8	14.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	28	29	30
°	′	′	′
0	17.2	17.4	17.6
4	17.2	17.4	17.6
8	17.2	17.4	17.5
12	17.2	17.4	17.5
16	17.1	17.3	17.5
20	17.1	17.3	17.4
24	17.0	17.2	17.3
28	16.9	17.1	17.2
32	16.8	17.0	17.1
36	16.7	16.9	17.0
40	16.6	16.8	16.9
44	16.5	16.6	16.7
48	16.4	16.5	16.6
52	16.3	16.4	16.4
56	16.1	16.2	16.3
60	16.0	16.1	16.1
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.1	15.0	15.0
88	15.0	14.9	14.8
90			

Subtract from table, back cover

Full Moon 29

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
31 0	129 55.1	132 13.9	− 0 22.0	135 17.7	− 2 59.2	89 57.8	+14 32.6	283 40.3	− 8 06.9	346 00.8	156	+13 24.7	−122
1	144 57.5	147 14.2	20.7	150 18.4	58.5	105 00.0	32.7	298 42.8	06.9	0 35.4	156	13 12.5	−121
2	160 00.0	162 14.4	19.5	165 19.1	57.7	120 02.3	32.7	313 45.2	06.9	15 10.0	156	13 00.4	−122
3	175 02.5	177 14.6	·· 18.2	180 19.8	·· 56.9	135 04.6	·· 32.8	328 47.6	·· 06.9	29 44.6	157	·12 48.2	−123
4	190 04.9	192 14.9	17.0	195 20.6	56.1	150 06.8	32.9	343 50.1	06.9	44 19.3	158	12 35.9	−123
5	205 07.4	207 15.1	15.7	210 21.3	55.3	165 09.1	33.0	358 52.5	06.9	58 54.1	158	12 23.6	−123
6	220 09.9	222 15.3	− 0 14.5	225 22.0	− 2 54.5	180 11.3	+14 33.0	13 55.0	− 8 06.9	73 28.9	158	+12 11.3	−124
7	235 12.3	237 15.6	13.2	240 22.7	53.7	195 13.6	33.1	28 57.4	06.9	88 03.7	159	11 58.9	−124
8	250 14.8	252 15.8	12.0	255 23.5	53.0	210 15.8	33.2	43 59.8	06.9	102 38.6	160	11 46.5	−125
9	265 17.3	267 16.0	·· 10.7	270 24.2	·· 52.2	225 18.1	·· 33.3	59 02.3	·· 06.9	117 13.6	160	·11 34.0	−125
10	280 19.7	282 16.3	09.5	285 24.9	51.4	240 20.4	33.3	74 04.7	06.9	131 48.6	160	11 21.5	−126
11	295 22.2	297 16.5	08.2	300 25.6	50.6	255 22.6	33.4	89 07.2	06.9	146 23.6	161	11 08.9	−126
12	310 24.7	312 16.8	− 0 07.0	315 26.4	− 2 49.8	270 24.9	+14 33.5	104 09.6	− 8 06.9	160 58.7	161	+10 56.3	−126
13	325 27.1	327 17.0	05.7	330 27.1	49.0	285 27.1	33.6	119 12.0	06.9	175 33.8	162	10 43.7	−127
14	340 29.6	342 17.2	04.5	345 27.8	48.2	300 29.4	33.7	134 14.5	06.9	190 09.0	162	10 31.0	−127
15	355 32.0	357 17.5	·· 03.2	0 28.5	·· 47.4	315 31.6	·· 33.7	149 16.9	·· 06.9	204 44.2	163	·10 18.3	−127
16	10 34.5	12 17.7	02.0	15 29.3	46.7	330 33.9	33.8	164 19.4	06.9	219 19.5	163	10 05.6	−128
17	25 37.0	27 18.0	− 0 00.7	30 30.0	45.9	345 36.2	33.9	179 21.8	06.9	233 54.8	163	9 52.8	−128
18	40 39.4	42 18.2	+ 0 00.5	45 30.7	− 2 45.1	0 38.4	+14 34.0	194 24.2	− 8 06.9	248 30.1	164	+ 9 40.0	−128
19	55 41.9	57 18.5	01.8	60 31.5	44.3	15 40.7	34.0	209 26.7	06.9	263 05.5	164	9 27.2	−129
20	70 44.4	72 18.7	03.0	75 32.2	43.5	30 42.9	34.1	224 29.1	06.9	277 40.9	164	9 14.3	−129
21	85 46.8	87 19.0	·· 04.3	90 32.9	·· 42.7	45 45.2	·· 34.2	239 31.6	·· 06.9	292 16.3	165	· 9 01.4	−129
22	100 49.3	102 19.2	05.5	105 33.6	41.9	60 47.4	34.3	254 34.0	06.9	306 51.8	166	8 48.5	−130
23	115 51.8	117 19.5	06.7	120 34.4	41.1	75 49.7	34.3	269 36.5	06.9	321 27.4	165	8 35.5	−130
1 0	130 54.2	132 19.7	+ 0 08.0	135 35.1	− 2 40.4	90 51.9	+14 34.4	284 38.9	− 8 06.9	336 02.9	166	+ 8 22.5	−130
1	145 56.7	147 20.0	09.2	150 35.8	39.6	105 54.2	34.5	299 41.3	06.8	350 38.5	166	8 09.5	−131
2	160 59.1	162 20.2	10.5	165 36.5	38.8	120 56.4	34.6	314 43.8	06.8	5 14.1	167	7 56.4	−130
3	176 01.6	177 20.5	·· 11.7	180 37.3	·· 38.0	135 58.7	·· 34.7	329 46.2	·· 06.8	19 49.8	167	· 7 43.4	−131
4	191 04.1	192 20.7	13.0	195 38.0	37.2	151 00.9	34.7	344 48.7	06.8	34 25.5	167	7 30.3	−132
5	206 06.5	207 21.0	14.2	210 38.7	36.4	166 03.2	34.8	359 51.1	06.8	49 01.2	167	7 17.1	−131
6	221 09.0	222 21.2	+ 0 15.5	225 39.5	− 2 35.6	181 05.4	+14 34.9	14 53.6	− 8 06.8	63 36.9	168	+ 7 04.0	−132
7	236 11.5	237 21.5	16.7	240 40.2	34.9	196 07.7	35.0	29 56.0	06.8	78 12.7	168	6 50.8	−132
8	251 13.9	252 21.7	18.0	255 40.9	34.1	211 09.9	35.0	44 58.5	06.8	92 48.5	169	6 37.6	−132
9	266 16.4	267 22.0	·· 19.2	270 41.6	·· 33.3	226 12.2	·· 35.1	60 00.9	·· 06.8	107 24.4	168	· 6 24.4	−133
10	281 18.9	282 22.3	20.5	285 42.4	32.5	241 14.4	35.2	75 03.3	06.8	122 00.2	169	6 11.1	−132
11	296 21.3	297 22.5	21.7	300 43.1	31.7	256 16.7	35.3	90 05.8	06.8	136 36.1	169	5 57.9	−133
12	311 23.8	312 22.8	+ 0 22.9	315 43.8	− 2 30.9	271 18.9	+14 35.4	105 08.2	− 8 06.8	151 12.0	169	+ 5 44.6	−133
13	326 26.3	327 23.0	24.2	330 44.6	30.1	286 21.2	35.4	120 10.7	06.8	165 47.9	170	5 31.3	−133
14	341 28.7	342 23.3	25.4	345 45.3	29.3	301 23.4	35.5	135 13.1	06.8	180 23.9	169	5 18.0	−134
15	356 31.2	357 23.6	·· 26.7	0 46.0	·· 28.6	316 25.7	·· 35.6	150 15.6	·· 06.8	194 59.8	170	· 5 04.6	−133
16	11 33.6	12 23.8	27.9	15 46.7	27.8	331 27.9	35.7	165 18.0	06.8	209 35.8	170	4 51.3	−134
17	26 36.1	27 24.1	29.2	30 47.5	27.0	346 30.2	35.8	180 20.5	06.8	224 11.8	171	4 37.9	−134
18	41 38.6	42 24.3	+ 0 30.4	45 48.2	− 2 26.2	1 32.4	+14 35.8	195 22.9	− 8 06.8	238 47.9	170	+ 4 24.5	−134
19	56 41.0	57 24.6	31.7	60 48.9	25.4	16 34.7	35.9	210 25.4	06.8	253 23.9	171	4 11.1	−134
20	71 43.5	72 24.9	32.9	75 49.7	24.6	31 36.9	36.0	225 27.8	06.8	268 00.0	170	3 57.7	−135
21	86 46.0	87 25.1	·· 34.2	90 50.4	·· 23.8	46 39.2	·· 36.1	240 30.2	·· 06.8	282 36.0	171	· 3 44.2	−134
22	101 48.4	102 25.4	35.4	105 51.1	23.0	61 41.4	36.2	255 32.7	06.7	297 12.1	171	3 30.8	−135
23	116 50.9	117 25.7	36.6	120 51.8	22.3	76 43.7	36.2	270 35.1	06.7	311 48.2	171	3 17.3	−134
2 0	131 53.4	132 25.9	+ 0 37.9	135 52.6	− 2 21.5	91 45.9	+14 36.3	285 37.6	− 8 06.7	326 24.3	171	+ 3 03.9	−135
1	146 55.8	147 26.2	39.1	150 53.3	20.7	106 48.1	36.4	300 40.0	06.7	341 00.4	172	2 50.4	−135
2	161 58.3	162 26.5	40.4	165 54.0	19.9	121 50.4	36.5	315 42.5	06.7	355 36.6	171	2 36.9	−135
3	177 00.7	177 26.8	·· 41.6	180 54.8	·· 19.1	136 52.6	·· 36.5	330 44.9	·· 06.7	10 12.7	172	· 2 23.4	−135
4	192 03.2	192 27.0	42.9	195 55.5	18.3	151 54.9	36.6	345 47.4	06.7	24 48.9	171	2 09.9	−136
5	207 05.7	207 27.3	44.1	210 56.2	17.5	166 57.1	36.7	0 49.8	06.7	39 25.0	172	1 56.3	−135
6	222 08.1	222 27.6	+ 0 45.3	225 57.0	− 2 16.7	181 59.4	+14 36.8	15 52.3	− 8 06.7	54 01.2	172	+ 1 42.8	−135
7	237 10.6	237 27.8	46.6	240 57.7	16.0	197 01.6	36.9	30 54.7	06.7	68 37.4	171	1 29.3	−135
8	252 13.1	252 28.1	47.8	255 58.4	15.2	212 03.8	36.9	45 57.2	06.7	83 13.5	172	1 15.8	−136
9	267 15.5	267 28.4	·· 49.1	270 59.1	·· 14.4	227 06.1	·· 37.0	60 59.6	·· 06.7	97 49.7	172	· 1 02.2	−135
10	282 18.0	282 28.7	50.3	285 59.9	13.6	242 08.3	37.1	76 02.1	06.7	112 25.9	172	0 48.7	−136
11	297 20.5	297 29.0	51.6	301 00.6	12.8	257 10.6	37.2	91 04.5	06.7	127 02.1	171	0 35.1	−135
12	312 22.9	312 29.2	+ 0 52.8	316 01.3	− 2 12.0	272 12.8	+14 37.3	106 07.0	− 8 06.7	141 38.2	172	+ 0 21.6	−136
13	327 25.4	327 29.5	54.0	331 02.1	11.2	287 15.1	37.4	121 09.4	06.7	156 14.4	172	+ 0 08.0	−136
14	342 27.9	342 29.8	55.3	346 02.8	10.5	302 17.3	37.4	136 11.9	06.7	170 50.6	172	− 0 05.6	−135
15	357 30.3	357 30.1	·· 56.5	1 03.5	·· 09.7	317 19.5	·· 37.5	151 14.3	·· 06.6	185 26.8	171	· 0 19.1	−136
16	12 32.8	12 30.3	57.8	16 04.3	08.9	332 21.8	37.6	166 16.8	06.6	200 02.9	172	0 32.7	−135
17	27 35.2	27 30.6	0 59.0	31 05.0	08.1	347 24.0	37.7	181 19.2	06.6	214 39.1	172	0 46.2	−136
18	42 37.7	42 30.9	+ 1 00.3	46 05.7	− 2 07.3	2 26.3	+14 37.8	196 21.7	− 8 06.6	229 15.3	171	− 0 59.8	−135
19	57 40.2	57 31.2	01.5	61 06.4	06.5	17 28.5	37.8	211 24.1	06.6	243 51.4	171	1 13.3	−136
20	72 42.6	72 31.5	02.7	76 07.2	05.7	32 30.7	37.9	226 26.6	06.6	258 27.5	172	1 26.9	−135
21	87 45.1	87 31.8	·· 04.0	91 07.9	·· 04.9	47 33.0	·· 38.0	241 29.0	·· 06.6	273 03.7	171	· 1 40.4	−136
22	102 47.6	102 32.0	05.2	106 08.6	04.2	62 35.2	38.1	256 31.5	06.6	287 39.8	171	1 54.0	−135
23	117 50.0	117 32.3	06.5	121 09.4	03.4	77 37.5	38.2	271 33.9	06.6	302 15.9	171	2 07.5	−136
24	132 52.5	132 32.6	+ 1 07.7	136 10.1	− 2 02.6	92 39.7	+14 38.2	286 36.4	− 8 06.6	316 52.0	171	− 2 21.1	−135
code	−	+ 2	+ 13	+ 8	+ 8	+ 23	0	+ 25	0				

GMT	SUN GHA	SUN Dec.
31 h 0	176 38.2	−17 31.4
1	191 38.1	30.7
2	206 38.0	30.0
3	221 37.9	29.3
4	236 37.8	28.6
5	251 37.7	27.9
6	266 37.6	−17 27.2
7	281 37.5	26.5
8	296 37.4	25.8
9	311 37.3	25.2
10	326 37.3	24.5
11	341 37.2	23.8
12	356 37.1	−17 23.1
13	11 37.0	22.4
14	26 36.9	21.7
15	41 36.8	21.0
16	56 36.7	20.3
17	71 36.6	19.6
18	86 36.5	−17 18.9
19	101 36.4	18.2
20	116 36.4	17.5
21	131 36.3	16.7
22	146 36.2	16.0
23	161 36.1	15.3
1 0	176 36.0	−17 14.6
1	191 35.9	13.9
2	206 35.8	13.2
3	221 35.7	12.5
4	236 35.7	11.8
5	251 35.6	11.1
6	266 35.5	−17 10.4
7	281 35.4	09.7
8	296 35.3	09.0
9	311 35.2	08.3
10	326 35.2	07.6
11	341 35.1	06.9
12	356 35.0	−17 06.1
13	11 34.9	05.4
14	26 34.8	04.7
15	41 34.7	04.0
16	56 34.7	03.3
17	71 34.6	02.6
18	86 34.5	−17 01.9
19	101 34.4	01.2
20	116 34.3	17 00.4
21	131 34.3	−16 59.7
22	146 34.2	59.0
23	161 34.1	58.3
2 0	176 34.0	−16 57.6
1	191 33.9	56.9
2	206 33.9	56.1
3	221 33.8	55.4
4	236 33.7	54.7
5	251 33.6	54.0
6	266 33.6	−16 53.3
7	281 33.5	52.5
8	296 33.4	51.8
9	311 33.3	51.1
10	326 33.3	50.4
11	341 33.2	49.6
12	356 33.1	−16 48.9
13	11 33.0	48.2
14	26 33.0	47.5
15	41 32.9	46.8
16	56 32.8	46.0
17	71 32.7	45.3
18	86 32.7	−16 44.6
19	101 32.6	43.8
20	116 32.5	43.1
21	131 32.4	42.4
22	146 32.4	41.7
23	161 32.3	40.9
24	176 32.2	−16 40.2
code	−	+ 7

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.5	−40 29.7
5	Achernar	336 00.3	−57 28.7
30	Acrux	173 59.9	−62 50.3
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	166 59.8	+56 12.4
34	Alkaid	153 34.2	+49 32.4
55	Al Na'ir	28 40.8	−47 11.5
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.4	+26 51.9
1	Alpheratz	358 30.7	+28 50.0
51	Altair	62 52.7	+ 8 44.4
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 22.0	−26 19.9
37	Arcturus	146 36.9	+19 25.2
43	Atria	109 04.9	−68 56.6
22	Avior	234 36.1	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 15.8	−52 40.3
12	Capella	281 41.1	+45 57.4
53	Deneb	50 02.9	+45 06.6
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.3	+62 00.0
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.6	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.4	−56 51.0
29	Gienah	176 38.8	−17 17.0
35	Hadar	149 52.4	−60 08.8
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.2	−34 24.6
40	Kochab	137 17.5	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.1	−36 08.4
24	Miapl'dus	221 48.8	−69 31.4
9	Mirfak	309 45.3	+49 42.1
50	Nunki	76 54.7	−26 21.5
52	Peacock	54 31.0	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.7	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.9	−60 38.5
44	Sabik	103 04.7	−15 40.2
3	Schedar	350 32.8	+56 17.1
45	Shaula	97 23.7	−37 04.3
18	Sirius	259 13.3	−16 39.1
33	Spica	159 18.9	−10 55.2
23	Suhail	223 25.5	−43 14.6
49	Vega	81 10.0	+38 44.1
39	Zub'g'bi	137 55.6	−15 51.0

GMT	Equation of Time (App.—Mean) 31	1	2
h	m s	m s	m s
0	−13 27.1	−13 35.8	−13 43.8
6	−13 29.3	−13 37.9	−13 45.6
12	−13 31.5	−13 39.9	−13 47.4
18	−13 33.7	−13 41.9	−13 49.2
24	−13 35.8	−13 43.8	−13 50.9

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 31 h m	1 h m	2 h m	3 h m
72	10 29	5 54	17 18	19 17	21 10	23 07
70	9 46	5 53	17 34	19 23	21 08	22 55
68	9 18	5 53	17 46	19 27	21 06	22 46
66	8 57	5 53	17 57	19 31	21 04	22 38
64	8 40	5 51	18 05	19 35	21 03	22 31
62	8 26	5 51	18 13	19 38	21 01	22 26
60	8 14	5 50	18 19	19 40	21 00	22 21
58	8 04	5 48	18 25	19 42	20 59	22 17
56	7 55	5 47	18 30	19 44	20 58	22 13
54	7 48	5 46	18 34	19 46	20 58	22 10
52	7 40	5 45	18 38	19 48	20 57	22 06
50	7 34	5 43	18 42	19 49	20 56	22 04
45	7 20	5 40	18 49	19 52	20 55	21 58
40	7 09	5 37	18 56	19 55	20 54	21 53
35	6 59	5 33	19 01	19 57	20 53	21 48
30	6 51	5 29	19 06	19 59	20 52	21 45
20	6 36	5 20	19 15	20 03	20 50	21 38
10	6 23	5 10	19 22	20 06	20 49	21 33
0	6 10	4 58	19 29	20 09	20 48	21 27
10	5 58	4 43	19 36	20 11	20 47	21 22
20	5 44	4 24	19 43	20 15	20 45	21 17
30	5 28	3 59	19 51	20 18	20 44	21 11
35	5 19	3 42	19 56	20 20	20 43	21 07
40	5 09	3 21	20 01	20 22	20 42	21 03
45	4 57	2 52	20 07	20 25	20 41	20 58
50	4 41	2 10	20 15	20 28	20 40	20 53
52	4 34	1 43	20 18	20 29	20 40	20 50
54	4 26	1 00	20 22	20 31	20 39	20 48
56	4 18	////	20 26	20 32	20 39	20 45
58	4 07	////	20 31	20 34	20 38	20 41
60 S	3 56	////	20 36	20 36	20 37	20 38

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 31 h m	1 h m	2 h m	3 h m
72	14 00	18 38	9 44	9 10	8 41	8 12
70	14 42	18 38	9 26	9 01	8 39	8 18
68	15 10	18 38	9 11	8 54	8 38	8 23
66	15 31	18 38	8 59	8 48	8 37	8 27
64	15 48	18 39	8 49	8 43	8 36	8 30
62	16 02	18 40	8 41	8 38	8 36	8 33
60	16 14	18 41	8 33	8 35	8 35	8 36
58	16 24	18 42	8 27	8 31	8 35	8 38
56	16 33	18 43	8 21	8 28	8 34	8 40
54	16 41	18 44	8 16	8 25	8 34	8 42
52	16 48	18 45	8 11	8 23	8 33	8 44
50	16 54	18 46	8 06	8 20	8 33	8 45
45	17 08	18 49	7 57	8 15	8 32	8 49
40	17 19	18 52	7 49	8 11	8 31	8 52
35	17 29	18 56	7 42	8 07	8 31	8 54
30	17 37	18 59	7 36	8 04	8 30	8 56
20	17 52	19 08	7 26	7 58	8 29	9 00
10	18 05	19 18	7 16	7 53	8 28	9 04
0	18 17	19 29	7 08	7 48	8 27	9 07
10	18 30	19 44	6 59	7 43	8 27	9 10
20	18 43	20 02	6 49	7 38	8 26	9 13
30	18 59	20 28	6 38	7 32	8 25	9 17
35	19 08	20 44	6 32	7 29	8 24	9 19
40	19 18	21 05	6 25	7 25	8 23	9 22
45	19 30	21 32	6 16	7 20	8 22	9 25
50	19 45	22 14	6 06	7 14	8 21	9 29
52	19 52	22 39	6 01	7 12	8 21	9 30
54	20 00	23 18	5 56	7 09	8 20	9 32
56	20 09	////	5 50	7 06	8 20	9 34
58	20 18	////	5 44	7 02	8 19	9 36
60 S	20 30	////	5 36	6 58	8 19	9 39

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
31	0 58	15 11	14 58	17 58	5 05
1	1 39	15 10	14 57	17 54	5 01
2	2 18	15 10	14 56	17 50	4 57
3	2 57	15 10	14 55	17 47	4 53

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add	Venus Add	Mars Add
	′	′	′
0	0.6	0.2	0.1
30	0.6	0.2	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	31 ′	1 ′	2 ′
0	11.7	11.7	11.9
4	11.7	11.7	11.9
8	11.8	11.8	11.9
12	11.8	11.8	11.9
16	11.9	11.9	12.0
20	12.0	12.0	12.1
24	12.0	12.0	12.2
28	12.1	12.1	12.2
32	12.2	12.2	12.4
36	12.4	12.4	12.5
40	12.5	12.5	12.6
44	12.6	12.6	12.7
48	12.8	12.8	12.9
52	13.0	13.0	13.1
56	13.1	13.1	13.2
60	13.3	13.3	13.4
64	13.5	13.5	13.6
68	13.7	13.7	13.8
72	13.9	13.9	14.0
76	14.1	14.1	14.2
80	14.3	14.3	14.4
84	14.5	14.5	14.6
88	14.7	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	31 ′	1 ′	2 ′
0	17.7	17.7	17.7
4	17.7	17.7	17.6
8	17.7	17.7	17.6
12	17.6	17.6	17.6
16	17.6	17.6	17.5
20	17.5	17.5	17.5
24	17.4	17.4	17.4
28	17.3	17.3	17.3
32	17.2	17.2	17.2
36	17.1	17.1	17.0
40	17.0	17.0	16.9
44	16.8	16.8	16.8
48	16.7	16.7	16.6
52	16.5	16.5	16.5
56	16.3	16.3	16.3
60	16.1	16.1	16.1
64	16.0	16.0	15.9
68	15.8	15.8	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	14.9	14.9	15.0
88	14.8	14.8	14.8
90			

Subtract from table, back cover

Septuagesima Sunday 1

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
3 0	132 52.5	132 32.6	+ 1 07.7	136 10.1	− 2 02.6	92 39.7	+14 38.2	286 36.4	− 8 06.6	316 52.0	171	− 2 21.1	−135
1	147 55.0	147 32.9	08.9	151 10.8	01.8	107 41.9	38.3	301 38.8	06.6	331 28.1	171	2 34.6	−135
2	162 57.4	162 33.2	10.2	166 11.6	01.0	122 44.2	38.4	316 41.3	06.6	346 04.2	170	2 48.1	−135
3	177 59.9	177 33.5	•• 11.4	181 12.3	• 2 00.2	137 46.4	•• 38.5	331 43.7	•• 06.6	0 40.2	171	• 3 01.6	−136
4	193 02.4	192 33.8	12.7	196 13.0	1 59.4	152 48.6	38.6	346 46.2	06.6	15 16.3	170	3 15.2	−135
5	208 04.8	207 34.1	13.9	211 13.8	58.6	167 50.9	38.7	1 48.6	06.5	29 52.3	170	3 28.7	−134
6	223 07.3	222 34.4	+ 1 15.1	226 14.5	− 1 57.9	182 53.1	+14 38.7	16 51.1	− 8 06.5	44 28.3	170	− 3 42.1	−135
7	238 09.7	237 34.7	16.4	241 15.2	57.1	197 55.3	38.8	31 53.5	06.5	59 04.3	169	3 55.6	−135
8	253 12.2	252 34.9	17.6	256 15.9	56.3	212 57.6	38.9	46 56.0	06.5	73 40.2	170	4 09.1	−135
9	268 14.7	267 35.2	•• 18.9	271 16.7	•• 55.5	227 59.8	•• 39.0	61 58.4	•• 06.5	88 16.2	169	• 4 22.6	−134
10	283 17.1	282 35.5	20.1	286 17.4	54.7	243 02.1	39.1	77 00.9	06.5	102 52.1	169	4 36.0	−134
11	298 19.6	297 35.8	21.3	301 18.1	53.9	258 04.3	39.1	92 03.3	06.5	117 28.0	169	4 49.4	−135
12	313 22.1	312 36.1	+ 1 22.6	316 18.9	− 1 53.1	273 06.5	+14 39.2	107 05.8	− 8 06.5	132 03.9	168	− 5 02.9	−134
13	328 24.5	327 36.4	23.8	331 19.6	52.3	288 08.8	39.3	122 08.2	06.5	146 39.7	169	5 16.3	−134
14	343 27.0	342 36.7	25.1	346 20.3	51.6	303 11.0	39.4	137 10.7	06.5	161 15.6	167	5 29.7	−133
15	358 29.5	357 37.0	•• 26.3	1 21.1	•• 50.8	318 13.2	•• 39.5	152 13.1	•• 06.5	175 51.3	168	• 5 43.0	−134
16	13 31.9	12 37.3	27.5	16 21.8	50.0	333 15.5	39.6	167 15.6	06.5	190 27.1	167	5 56.4	−133
17	28 34.4	27 37.6	28.8	31 22.5	49.2	348 17.7	39.6	182 18.1	06.5	205 02.8	167	6 09.7	−133
18	43 36.8	42 37.9	+ 1 30.0	46 23.3	− 1 48.4	3 19.9	+14 39.7	197 20.5	− 8 06.4	219 38.5	167	− 6 23.0	−134
19	58 39.3	57 38.2	31.2	61 24.0	47.6	18 22.2	39.8	212 23.0	06.4	234 14.2	167	6 36.4	−132
20	73 41.8	72 38.5	32.5	76 24.7	46.8	33 24.4	39.9	227 25.4	06.4	248 49.9	166	6 49.6	−133
21	88 44.2	87 38.8	•• 33.7	91 25.5	•• 46.0	48 26.6	•• 40.0	242 27.9	•• 06.4	263 25.5	165	• 7 02.9	−132
22	103 46.7	102 39.1	35.0	106 26.2	45.3	63 28.9	40.1	257 30.3	06.4	278 01.0	166	7 16.1	−133
23	118 49.2	117 39.4	36.2	121 26.9	44.5	78 31.1	40.1	272 32.8	06.4	292 36.6	164	7 29.4	−132
4 0	133 51.6	132 39.8	+ 1 37.4	136 27.7	− 1 43.7	93 33.3	+14 40.2	287 35.2	− 8 06.4	307 12.0	165	− 7 42.6	−132
1	148 54.1	147 40.1	38.7	151 28.4	42.9	108 35.5	40.3	302 37.7	06.4	321 47.5	164	7 55.8	−131
2	163 56.6	162 40.4	39.9	166 29.1	42.1	123 37.8	40.4	317 40.2	06.4	336 22.9	164	8 08.9	−131
3	178 59.0	177 40.7	•• 41.1	181 29.9	•• 41.3	138 40.0	•• 40.5	332 42.6	•• 06.4	350 58.3	163	• 8 22.0	−131
4	194 01.5	192 41.0	42.4	196 30.6	40.5	153 42.2	40.6	347 45.1	06.4	5 33.6	163	8 35.1	−131
5	209 04.0	207 41.3	43.6	211 31.3	39.8	168 44.5	40.6	2 47.5	06.4	20 08.9	163	8 48.2	−131
6	224 06.4	222 41.6	+ 1 44.8	226 32.1	− 1 39.0	183 46.7	+14 40.7	17 50.0	− 8 06.3	34 44.2	162	− 9 01.3	−130
7	239 08.9	237 41.9	46.1	241 32.8	38.2	198 48.9	40.8	32 52.4	06.3	49 19.4	161	9 14.3	−130
8	254 11.3	252 42.2	47.3	256 33.5	37.4	213 51.2	40.9	47 54.9	06.3	63 54.5	161	9 27.3	−130
9	269 13.8	267 42.5	•• 48.5	271 34.3	•• 36.6	228 53.4	•• 41.0	62 57.3	•• 06.3	78 29.6	161	• 9 40.3	−129
10	284 16.3	282 42.9	49.8	286 35.0	35.8	243 55.6	41.1	77 59.8	06.3	93 04.7	160	9 53.2	−129
11	299 18.7	297 43.2	51.0	301 35.7	35.0	258 57.8	41.2	93 02.3	06.3	107 39.7	160	10 06.1	−129
12	314 21.2	312 43.5	+ 1 52.2	316 36.5	− 1 34.2	274 00.1	+14 41.2	108 04.7	− 8 06.3	122 14.7	159	−10 19.0	−128
13	329 23.7	327 43.8	53.5	331 37.2	33.5	289 02.3	41.3	123 07.2	06.3	136 49.6	158	10 31.8	−128
14	344 26.1	342 44.1	54.7	346 37.9	32.7	304 04.5	41.4	138 09.6	06.3	151 24.4	158	10 44.6	−128
15	359 28.6	357 44.4	•• 56.0	1 38.7	•• 31.9	319 06.7	•• 41.5	153 12.1	•• 06.3	165 59.2	158	•10 57.4	−127
16	14 31.1	12 44.8	57.2	16 39.4	31.1	334 09.0	41.6	168 14.5	06.2	180 34.0	157	11 10.1	−127
17	29 33.5	27 45.1	58.4	31 40.1	30.3	349 11.2	41.7	183 17.0	06.2	195 08.7	156	11 22.8	−127
18	44 36.0	42 45.4	+ 1 59.7	46 40.9	− 1 29.5	4 13.4	+14 41.7	198 19.5	− 8 06.2	209 43.3	156	−11 35.5	−126
19	59 38.4	57 45.7	2 00.9	61 41.6	28.7	19 15.6	41.8	213 21.9	06.2	224 17.9	155	11 48.1	−126
20	74 40.9	72 46.0	02.1	76 42.3	27.9	34 17.9	41.9	228 24.4	06.2	238 52.4	154	12 00.7	−126
21	89 43.4	87 46.4	•• 03.4	91 43.1	•• 27.2	49 20.1	•• 42.0	243 26.8	•• 06.2	253 26.8	154	•12 13.3	−125
22	104 45.8	102 46.7	04.6	106 43.8	26.4	64 22.3	42.1	258 29.3	06.2	268 01.2	154	12 25.8	−125
23	119 48.3	117 47.0	05.8	121 44.5	25.6	79 24.5	42.2	273 31.8	06.2	282 35.6	152	12 38.3	−124
5 0	134 50.8	132 47.3	+ 2 07.0	136 45.3	− 1 24.8	94 26.8	+14 42.3	288 34.2	− 8 06.2	297 09.8	153	−12 50.7	−124
1	149 53.2	147 47.7	08.3	151 46.0	24.0	109 29.0	42.3	303 36.7	06.2	311 44.1	151	13 03.1	−123
2	164 55.7	162 48.0	09.5	166 46.7	23.2	124 31.2	42.4	318 39.1	06.1	326 18.2	151	13 15.4	−123
3	179 58.2	177 48.3	•• 10.7	181 47.5	•• 22.4	139 33.4	•• 42.5	333 41.6	•• 06.1	340 52.3	150	•13 27.7	−123
4	195 00.6	192 48.7	12.0	196 48.2	21.7	154 35.7	42.6	348 44.1	06.1	355 26.3	149	13 40.0	−122
5	210 03.1	207 49.0	13.2	211 48.9	20.9	169 37.9	42.7	3 46.5	06.1	10 00.2	149	13 52.2	−122
6	225 05.6	222 49.3	+ 2 14.4	226 49.7	− 1 20.1	184 40.1	+14 42.8	18 49.0	− 8 06.1	24 34.1	148	−14 04.4	−121
7	240 08.0	237 49.7	15.7	241 50.4	19.3	199 42.3	42.9	33 51.4	06.1	39 07.9	147	14 16.5	−120
8	255 10.5	252 50.0	16.9	256 51.1	18.5	214 44.5	42.9	48 53.9	06.1	53 41.6	147	14 28.5	−121
9	270 12.9	267 50.3	•• 18.1	271 51.9	•• 17.7	229 46.8	•• 43.0	63 56.4	•• 06.1	68 15.3	146	•14 40.6	−119
10	285 15.4	282 50.7	19.4	286 52.6	16.9	244 49.0	43.1	78 58.8	06.1	82 48.9	145	14 52.5	−119
11	300 17.9	297 51.0	20.6	301 53.3	16.1	259 51.2	43.2	94 01.3	06.1	97 22.4	144	15 04.4	−119
12	315 20.3	312 51.3	+ 2 21.8	316 54.1	− 1 15.4	274 53.4	+14 43.3	109 03.7	− 8 06.0	111 55.8	144	−15 16.3	−118
13	330 22.8	327 51.7	23.0	331 54.8	14.6	289 55.7	43.4	124 06.2	06.0	126 29.2	142	15 28.1	−118
14	345 25.3	342 52.0	24.3	346 55.6	13.8	304 57.9	43.5	139 08.7	06.0	141 02.4	142	15 39.9	−117
15	0 27.7	357 52.3	•• 25.5	1 56.3	•• 13.0	320 00.1	•• 43.6	154 11.1	•• 06.0	155 35.6	142	•15 51.6	−116
16	15 30.2	12 52.7	26.7	16 57.0	12.2	335 02.3	43.6	169 13.6	06.0	170 08.8	140	16 03.2	−116
17	30 32.7	27 53.0	28.0	31 57.8	11.4	350 04.5	43.7	184 16.1	06.0	184 41.8	140	16 14.8	−115
18	45 35.1	42 53.4	+ 2 29.2	46 58.5	− 1 10.6	5 06.7	+14 43.8	199 18.5	− 8 06.0	199 14.8	138	−16 26.3	−115
19	60 37.6	57 53.7	30.4	61 59.2	09.8	20 09.0	43.9	214 21.0	06.0	213 47.6	138	16 37.8	−114
20	75 40.1	72 54.0	31.6	77 00.0	09.1	35 11.2	44.0	229 23.4	05.9	228 20.4	137	16 49.2	−113
21	90 42.5	87 54.4	•• 32.9	92 00.7	•• 08.3	50 13.4	•• 44.1	244 25.9	•• 05.9	242 53.1	137	•17 00.5	−113
22	105 45.0	102 54.7	34.1	107 01.4	07.5	65 15.6	44.2	259 28.4	05.9	257 25.8	135	17 11.8	−112
23	120 47.4	117 55.1	35.3	122 02.2	06.7	80 17.8	44.3	274 30.8	05.9	271 58.3	134	17 23.0	−112
24	135 49.9	132 55.4	+ 2 36.6	137 02.9	− 1 05.9	95 20.1	+14 44.3	289 33.3	− 8 05.9	286 30.7	134	−17 34.2	−111
code	−	+ 3	+ 13	+ 7	+ 7	+ 22	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.	STARS No.	Name	SHA	Dec.
	° ′	° ′			° ′	° ′
3 h 0	176 32.2	−16 40.2	7	Acamar	315 52.5	−40 29.7
1	191 32.2	39.5	5	Achernar	336 00.3	−57 28.7
2	206 32.1	38.7	30	Acrux	173 59.9	−62 50.3
3	221 32.0	38.0	19	Adhara	255 47.8	−28 54.5
4	236 32.0	37.3	10	Aldebaran	291 41.2	+16 25.1
5	251 31.9	36.6				
6	266 31.8	−16 35.8	32	Alioth	166 59.8	+56 12.4
7	281 31.8	35.1	34	Alkaid	153 34.2	+49 32.4
8	296 31.7	34.4	55	Al Na'ir	28 40.8	−47 11.5
9	311 31.6	33.6	15	Alnilam	276 32.1	− 1 13.8
10	326 31.6	32.9	25	Alphard	218 40.3	− 8 27.4
11	341 31.5	32.1				
12	356 31.4	−16 31.4	41	Alphecca	126 49.4	+26 51.9
13	11 31.4	30.7	1	Alpheratz	358 30.7	+28 50.0
14	26 31.3	29.9	51	Altair	62 52.7	+ 8 44.4
15	41 31.2	29.2	2	Ankaa	354 00.4	−42 33.8
16	56 31.2	28.5	42	Antares	113 22.0	−26 19.9
17	71 31.1	27.7				
18	86 31.0	−16 27.0	37	Arcturus	146 36.9	+19 25.2
19	101 31.0	26.3	43	Atria	109 04.9	−68 56.6
20	116 30.9	25.5	22	Avior	234 36.1	−59 21.5
21	131 30.8	24.8	13	Bellatrix	279 20.4	+ 6 18.6
22	146 30.8	24.0	16	Betelg'se	271 50.1	+ 7 24.0
23	161 30.7	23.3				
			17	Canopus	264 15.8	−52 40.3
4 h 0	176 30.7	−16 22.5	12	Capella	281 41.1	+45 57.4
1	191 30.6	21.8	53	Deneb	50 02.9	+45 06.6
2	206 30.5	21.1	28	Denebola	183 19.5	+14 49.8
3	221 30.5	20.3	4	Diphda	349 41.4	−18 14.7
4	236 30.4	19.6				
5	251 30.4	18.8	27	Dubhe	194 46.2	+62 00.0
6	266 30.3	−16 18.1	14	Elnath	279 09.7	+28 34.3
7	281 30.2	17.3	47	Eltanin	91 07.6	+51 29.3
8	296 30.2	16.6	54	Enif	34 31.9	+ 9 39.5
9	311 30.1	15.9	56	Fomalhaut	16 14.1	−29 52.4
10	326 30.1	15.1				
11	341 30.0	14.4	31	Gacrux	172 51.3	−56 51.0
12	356 29.9	−16 13.6	29	Gienah	176 38.8	−17 17.0
13	11 29.9	12.9	35	Hadar	149 52.3	−60 08.8
14	26 29.8	12.1	6	Hamal	328 52.0	+23 14.7
15	41 29.8	11.4	48	Kaus Aust.	84 44.2	−34 24.6
16	56 29.7	10.6				
17	71 29.7	09.9	40	Kochab	137 17.5	+74 20.4
18	86 29.6	−16 09.1	57	Markab	14 23.8	+14 57.2
19	101 29.5	08.4	8	Menkar	315 02.4	+ 3 54.5
20	116 29.5	07.6	36	Menkent	149 01.0	−36 08.4
21	131 29.4	06.9	24	Miapl'dus	221 48.8	−69 31.4
22	146 29.4	06.1				
23	161 29.3	05.4	9	Mirfak	309 45.3	+49 42.1
			50	Nunki	76 54.7	−26 21.5
5 h 0	176 29.3	−16 04.6	52	Peacock	54 30.9	−56 53.3
1	191 29.2	03.9	21	Pollux	244 22.7	+28 08.5
2	206 29.2	03.1	20	Procyon	245 46.8	+ 5 20.8
3	221 29.1	02.3				
4	236 29.1	01.6	46	R'alhague	96 48.7	+12 35.3
5	251 29.0	00.8	26	Regulus	208 31.3	+12 11.7
6	266 29.0	−16 00.1	11	Rigel	281 55.4	− 8 15.3
7	281 28.9	15 59.3	38	Rigil Kent.	140 53.8	−60 38.6
8	296 28.9	58.6	44	Sabik	103 04.7	−15 40.3
9	311 28.8	57.8				
10	326 28.8	57.1	3	Schedar	350 32.8	+56 17.1
11	341 28.7	56.3	45	Shaula	97 23.7	−37 04.3
12	356 28.7	−15 55.5	18	Sirius	259 13.3	−16 39.1
13	11 28.6	54.8	33	Spica	159 18.9	−10 55.2
14	26 28.6	54.0	23	Suhail	223 25.4	−43 14.6
15	41 28.5	53.3				
16	56 28.5	52.5	49	Vega	81 10.0	+38 44.1
17	71 28.4	51.7	39	Zub'g'bi	137 55.6	−15 51.0
18	86 28.4	−15 51.0				
19	101 28.3	50.2				
20	116 28.3	49.4				
21	131 28.2	48.7				
22	146 28.2	47.9				
23	161 28.1	47.2				
24	176 28.1	−15 46.4				
code	−	+ 7				

GMT	Equation of Time (App.—Mean) 3	4	5
h	m s	m s	m s
0	−13 50.9	−13 57.3	−14 02.8
6	−13 52.6	−13 58.7	−14 04.1
12	−13 54.2	−14 00.1	−14 05.3
18	−13 55.7	−14 01.5	−14 06.4
24	−13 57.3	−14 02.8	−14 07.5

Lat.	Sunrise	Twlt. begins	Moonrise 3	4	5	6
N °	h m	h m	h m	h m	h m	h m
72	10 05	5 44	23 07	25 19	1 19	■
70	9 30	5 45	22 55	24 52	0 52	3 21
68	9 05	5 45	22 46	24 32	0 32	2 36
66	8 46	5 45	22 38	24 17	0 17	2 06
64	8 31	5 45	22 31	24 04	0 04	1 44
62	8 18	5 45	22 26	23 53	25 27	1 27
60	8 07	5 44	22 21	23 44	25 12	1 12
58	7 58	5 43	22 17	23 37	25 00	1 00
56	7 50	5 43	22 13	23 30	24 50	0 50
54	7 42	5 42	22 10	23 23	24 40	0 40
52	7 36	5 41	22 06	23 18	24 32	0 32
50	7 30	5 40	22 04	23 13	24 25	0 25
45	7 17	5 37	21 58	23 02	24 09	0 09
40	7 06	5 34	21 53	22 53	23 56	25 01
35	6 57	5 32	21 48	22 46	23 45	24 47
30	6 49	5 27	21 45	22 39	23 36	24 35
20	6 35	5 20	21 38	22 28	23 20	24 14
10	6 22	5 10	21 33	22 18	23 05	23 56
0	6 11	4 58	21 27	22 09	22 52	23 40
10	5 59	4 44	21 22	21 59	22 39	23 23
20	5 46	4 26	21 17	21 50	22 26	23 06
30	5 31	4 02	21 11	21 39	22 10	22 46
35	5 23	3 47	21 07	21 32	22 01	22 34
40	5 13	3 25	21 03	21 25	21 51	22 21
45	5 01	2 59	20 58	21 17	21 39	22 05
50	4 47	2 20	20 53	21 07	21 24	21 46
52	4 40	1 57	20 50	21 03	21 17	21 36
54	4 33	1 24	20 48	20 58	21 10	21 26
56	4 24	////	20 45	20 52	21 02	21 15
58	4 15	////	20 41	20 46	20 52	21 02
60	4 04	////	20 38	20 39	20 42	20 47
S						

Lat.	Sunset	Twlt. ends	Moonset 3	4	5	6
N °	h m	h m	h m	h m	h m	h m
72	14 24	18 49	8 12	7 40	6 56	■
70	14 59	18 48	8 18	7 54	7 24	6 27
68	15 24	18 47	8 23	8 06	7 45	7 14
66	15 43	18 47	8 27	8 15	8 02	7 45
64	15 58	18 47	8 30	8 23	8 16	8 08
62	16 11	18 47	8 33	8 30	8 28	8 26
60	16 22	18 47	8 36	8 37	8 38	8 41
58	16 31	18 47	8 38	8 42	8 47	8 54
56	16 39	18 48	8 40	8 47	8 55	9 06
54	16 47	18 49	8 42	8 51	9 02	9 16
52	16 53	18 49	8 44	8 55	9 08	9 24
50	16 59	18 50	8 45	8 59	9 14	9 32
45	17 12	18 52	8 49	9 06	9 26	9 50
40	17 23	18 55	8 52	9 13	9 36	10 04
35	17 32	18 58	8 54	9 19	9 45	10 16
30	17 40	19 02	8 56	9 23	9 53	10 26
20	17 54	19 09	9 00	9 32	10 06	10 44
10	18 06	19 18	9 04	9 40	10 18	11 00
0	18 18	19 30	9 07	9 47	10 29	11 15
10	18 29	19 43	9 10	9 54	10 40	11 29
20	18 42	20 00	9 13	10 02	10 52	11 45
30	18 56	20 24	9 17	10 11	11 06	12 04
35	19 05	20 40	9 19	10 16	11 14	12 15
40	19 15	21 00	9 22	10 22	11 23	12 27
45	19 26	21 26	9 25	10 29	11 34	12 42
50	19 40	22 04	9 29	10 37	11 47	13 00
52	19 47	22 26	9 30	10 41	11 53	13 08
54	19 54	22 57	9 32	10 45	12 00	13 18
56	20 02	////	9 34	10 49	12 07	13 29
58	20 11	////	9 36	10 55	12 16	13 41
60	20 22	////	9 39	11 00	12 26	13 56
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
3	2 57	15 10	14 55	17 47	4 53
4	3 37	15 09	14 53	17 43	4 49
5	4 19	15 09	14 52	17 40	4 45
6	5 03	15 08	14 51	17 36	4 41

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.2	0.1
30	0.6	0.2	0.1
45	0.6	0.1	0.0
60	0.6	0.1	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	3	4	5
°	′	′	′
0	12.0	12.4	13.0
4	12.0	12.4	13.0
8	12.0	12.4	13.0
12	12.1	12.4	13.1
16	12.1	12.5	13.1
20	12.2	12.6	13.2
24	12.3	12.6	13.2
28	12.4	12.7	13.3
32	12.5	12.8	13.3
36	12.6	12.9	13.4
40	12.7	13.0	13.5
44	12.8	13.1	13.6
48	13.0	13.3	13.7
52	13.1	13.4	13.8
56	13.3	13.5	13.9
60	13.5	13.7	14.1
64	13.6	13.9	14.2
68	13.8	14.0	14.3
72	14.0	14.2	14.5
76	14.2	14.4	14.6
80	14.4	14.5	14.7
84	14.6	14.7	14.9
88	14.7	14.8	15.0
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	3	4	5
°	′	′	′
0	17.6	17.4	17.0
4	17.6	17.4	17.0
8	17.5	17.3	17.0
12	17.5	17.3	16.9
16	17.5	17.2	16.9
20	17.4	17.2	16.9
24	17.3	17.1	16.8
28	17.2	17.0	16.7
32	17.1	16.9	16.7
36	17.0	16.8	16.6
40	16.9	16.7	16.5
44	16.7	16.6	16.4
48	16.6	16.5	16.3
52	16.4	16.3	16.2
56	16.3	16.2	16.1
60	16.1	16.0	15.9
64	15.9	15.9	15.8
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.3
84	15.0	15.0	15.1
88	14.8	14.9	15.0
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
6 0	135 49.9	132 55.4	+ 2 36.6	137 02.9	− 1 05.9	95 20.1	+14 44.3	289 33.3	− 8 05.9	286 30.7	134	−17 34.2	111
1	150 52.4	147 55.8	37.8	152 03.6	05.1	110 22.3	44.4	304 35.8	05.9	301 03.1	133	17 45.3	110
2	165 54.8	162 56.1	39.0	167 04.4	04.3	125 24.5	44.5	319 38.2	05.9	315 35.4	132	17 56.3	109
3	180 57.3	177 56.5	•• 40.2	182 05.1	•• 03.6	140 26.7	•• 44.6	334 40.7	•• 05.9	330 07.6	131	•18 07.2	109
4	195 59.8	192 56.8	41.5	197 05.9	02.8	155 28.9	44.7	349 43.2	05.9	344 39.7	130	18 18.1	108
5	211 02.2	207 57.1	42.7	212 06.6	02.0	170 31.1	44.8	4 45.6	05.8	359 11.7	129	18 28.9	108
6	226 04.7	222 57.5	+ 2 43.9	227 07.3	− 1 01.2	185 33.3	+14 44.9	19 48.1	− 8 05.8	13 43.6	128	−18 39.7	106
7	241 07.2	237 57.8	45.1	242 08.1	1 00.4	200 35.6	45.0	34 50.5	05.8	28 15.4	127	18 50.3	106
8	256 09.6	252 58.2	46.4	257 08.8	0 59.6	215 37.8	45.0	49 53.0	05.8	42 47.1	126	19 00.9	106
9	271 12.1	267 58.6	•• 47.6	272 09.5	•• 58.8	230 40.0	•• 45.1	64 55.5	•• 05.8	57 18.7	126	•19 11.5	104
10	286 14.6	282 58.9	48.8	287 10.3	58.1	245 42.2	45.2	79 57.9	05.8	71 50.3	124	19 21.9	104
11	301 17.0	297 59.3	50.0	302 11.0	57.3	260 44.4	45.3	95 00.4	05.8	86 21.7	123	19 32.3	103
12	316 19.5	312 59.6	+ 2 51.3	317 11.7	− 0 56.5	275 46.6	+14 45.4	110 02.9	− 8 05.8	100 53.0	123	−19 42.6	102
13	331 21.9	328 00.0	52.5	332 12.5	55.7	290 48.8	45.5	125 05.3	05.7	115 24.3	121	19 52.8	101
14	346 24.4	343 00.3	53.7	347 13.2	54.9	305 51.1	45.6	140 07.8	05.7	129 55.4	120	20 02.9	100
15	1 26.9	358 00.7	•• 54.9	2 13.9	•• 54.1	320 53.3	•• 45.7	155 10.3	•• 05.7	144 26.4	120	•20 12.9	100
16	16 29.3	13 01.0	56.2	17 14.7	53.3	335 55.5	45.8	170 12.7	05.7	158 57.4	118	20 22.9	99
17	31 31.8	28 01.4	57.4	32 15.4	52.5	350 57.7	45.8	185 15.2	05.7	173 28.2	118	20 32.8	98
18	46 34.3	43 01.8	+ 2 58.6	47 16.2	− 0 51.8	5 59.9	+14 45.9	200 17.7	− 8 05.7	187 59.0	116	−20 42.6	97
19	61 36.7	58 02.1	2 59.8	62 16.9	51.0	21 02.1	46.0	215 20.1	05.7	202 29.6	115	20 52.3	96
20	76 39.2	73 02.5	3 01.0	77 17.6	50.2	36 04.3	46.1	230 22.6	05.7	217 00.1	115	21 01.9	95
21	91 41.7	88 02.9	•• 02.3	92 18.4	•• 49.4	51 06.5	•• 46.2	245 25.1	•• 05.6	231 30.6	113	•21 11.4	95
22	106 44.1	103 03.2	03.5	107 19.1	48.6	66 08.7	46.3	260 27.5	05.6	246 00.9	112	21 20.9	93
23	121 46.6	118 03.6	04.7	122 19.8	47.8	81 11.0	46.4	275 30.0	05.6	260 31.1	111	21 30.2	93
7 0	136 49.0	133 03.9	+ 3 05.9	137 20.6	− 0 47.0	96 13.2	+14 46.5	290 32.5	− 8 05.6	275 01.2	111	−21 39.5	91
1	151 51.5	148 04.3	07.1	152 21.3	46.3	111 15.4	46.6	305 34.9	05.6	289 31.3	109	21 48.6	91
2	166 54.0	163 04.7	08.4	167 22.1	45.5	126 17.6	46.6	320 37.4	05.6	304 01.2	108	21 57.7	90
3	181 56.4	178 05.0	•• 09.6	182 22.8	•• 44.7	141 19.8	•• 46.7	335 39.9	•• 05.6	318 31.0	107	•22 06.7	88
4	196 58.9	193 05.4	10.8	197 23.5	43.9	156 22.0	46.8	350 42.4	05.5	333 00.7	106	22 15.5	88
5	212 01.4	208 05.8	12.0	212 24.3	43.1	171 24.2	46.9	5 44.8	05.5	347 30.3	104	22 24.3	87
6	227 03.8	223 06.2	+ 3 13.3	227 25.0	− 0 42.3	186 26.4	+14 47.0	20 47.3	− 8 05.5	1 59.7	104	−22 33.0	85
7	242 06.3	238 06.5	14.5	242 25.7	41.5	201 28.6	47.1	35 49.8	05.5	16 29.1	103	22 41.5	85
8	257 08.8	253 06.9	15.7	257 26.5	40.8	216 30.8	47.2	50 52.2	05.5	30 58.4	101	22 50.0	84
9	272 11.2	268 07.3	•• 16.9	272 27.2	•• 40.0	231 33.0	•• 47.3	65 54.7	•• 05.5	45 27.5	101	•22 58.4	82
10	287 13.7	283 07.6	18.1	287 28.0	39.2	246 35.3	47.4	80 57.2	05.5	59 56.6	99	23 06.6	82
11	302 16.2	298 08.0	19.3	302 28.7	38.4	261 37.5	47.5	95 59.6	05.5	74 25.5	99	23 14.8	80
12	317 18.6	313 08.4	+ 3 20.6	317 29.4	− 0 37.6	276 39.7	+14 47.5	111 02.1	− 8 05.4	88 54.4	97	−23 22.8	79
13	332 21.1	328 08.8	21.8	332 30.2	36.8	291 41.9	47.6	126 04.6	05.4	103 23.1	96	23 30.7	78
14	347 23.5	343 09.2	23.0	347 30.9	36.0	306 44.1	47.7	141 07.0	05.4	117 51.7	95	23 38.5	77
15	2 26.0	358 09.5	•• 24.2	2 31.6	•• 35.3	321 46.3	•• 47.8	156 09.5	•• 05.4	132 20.2	94	•23 46.2	76
16	17 28.5	13 09.9	25.4	17 32.4	34.5	336 48.5	47.9	171 12.0	05.4	146 48.6	93	23 53.8	75
17	32 30.9	28 10.3	26.7	32 33.1	33.7	351 50.7	48.0	186 14.5	05.4	161 16.9	92	24 01.3	73
18	47 33.4	43 10.7	+ 3 27.9	47 33.9	− 0 32.9	6 52.9	+14 48.1	201 16.9	− 8 05.3	175 45.1	90	−24 08.6	73
19	62 35.9	58 11.1	29.1	62 34.6	32.1	21 55.1	48.2	216 19.4	05.3	190 13.1	90	24 15.9	71
20	77 38.3	73 11.4	30.3	77 35.3	31.3	36 57.3	48.3	231 21.9	05.3	204 41.1	89	24 23.0	70
21	92 40.8	88 11.8	•• 31.5	92 36.1	•• 30.5	51 59.5	•• 48.4	246 24.3	•• 05.3	219 09.0	87	•24 30.0	68
22	107 43.3	103 12.2	32.7	107 36.8	29.8	67 01.7	48.5	261 26.8	05.3	233 36.7	86	24 36.8	68
23	122 45.7	118 12.6	34.0	122 37.5	29.0	82 03.9	48.5	276 29.3	05.3	248 04.3	86	24 43.6	66
8 0	137 48.2	133 13.0	+ 3 35.2	137 38.3	− 0 28.2	97 06.1	+14 48.6	291 31.8	− 8 05.3	262 31.9	84	−24 50.2	65
1	152 50.7	148 13.4	36.4	152 39.0	27.4	112 08.3	48.7	306 34.2	05.2	276 59.3	83	24 56.7	63
2	167 53.1	163 13.7	37.6	167 39.8	26.6	127 10.5	48.8	321 36.7	05.2	291 26.6	82	25 03.0	63
3	182 55.6	178 14.1	•• 38.8	182 40.5	•• 25.8	142 12.7	•• 48.9	336 39.2	•• 05.2	305 53.8	81	•25 09.3	61
4	197 58.0	193 14.5	40.0	197 41.2	25.0	157 14.9	49.0	351 41.7	05.2	320 20.9	80	25 15.4	59
5	213 00.5	208 14.9	41.2	212 42.0	24.3	172 17.1	49.1	6 44.1	05.2	334 47.9	79	25 21.3	59
6	228 03.0	223 15.3	+ 3 42.5	227 42.7	− 0 23.5	187 19.3	+14 49.2	21 46.6	− 8 05.2	349 14.8	77	−25 27.2	57
7	243 05.4	238 15.7	43.7	242 43.5	22.7	202 21.5	49.3	36 49.1	05.2	3 41.5	77	25 32.9	55
8	258 07.9	253 16.1	44.9	257 44.2	21.9	217 23.7	49.4	51 51.5	05.1	18 08.2	76	25 38.4	55
9	273 10.4	268 16.5	•• 46.1	272 44.9	•• 21.1	232 25.9	•• 49.5	66 54.0	•• 05.1	32 34.8	75	•25 43.9	52
10	288 12.8	283 16.9	47.3	287 45.7	20.3	247 28.1	49.6	81 56.5	05.1	47 01.3	73	25 49.1	52
11	303 15.3	298 17.3	48.5	302 46.4	19.5	262 30.3	49.7	96 59.0	05.1	61 27.6	73	25 54.3	50
12	318 17.8	313 17.7	+ 3 49.7	317 47.2	− 0 18.8	277 32.5	+14 49.7	112 01.4	− 8 05.1	75 53.9	72	−25 59.3	48
13	333 20.2	328 18.1	50.9	332 47.9	18.0	292 34.7	49.8	127 03.9	05.1	90 20.1	70	26 04.1	47
14	348 22.7	343 18.5	52.2	347 48.6	17.2	307 36.9	49.9	142 06.4	05.0	104 46.1	70	26 08.8	46
15	3 25.2	358 18.9	•• 53.4	2 49.4	•• 16.4	322 39.1	•• 50.0	157 08.9	•• 05.0	119 12.1	69	•26 13.4	44
16	18 27.6	13 19.3	54.6	17 50.1	15.6	337 41.3	50.1	172 11.3	05.0	133 38.0	67	26 17.8	43
17	33 30.1	28 19.7	55.8	32 50.8	14.8	352 43.5	50.2	187 13.8	05.0	148 03.7	67	26 22.1	41
18	48 32.5	43 20.1	+ 3 57.0	47 51.6	− 0 14.0	7 45.7	+14 50.3	202 16.3	− 8 05.0	162 29.4	66	−26 26.2	40
19	63 35.0	58 20.5	58.2	62 52.3	13.3	22 47.9	50.4	217 18.8	05.0	176 55.0	64	26 30.2	38
20	78 37.5	73 20.9	3 59.4	77 53.1	12.5	37 50.1	50.5	232 21.2	04.9	191 20.4	64	26 34.0	37
21	93 39.9	88 21.3	• 4 00.6	92 53.8	•• 11.7	52 52.3	•• 50.6	247 23.7	•• 04.9	205 45.8	63	•26 37.7	35
22	108 42.4	103 21.7	01.8	107 54.5	10.9	67 54.5	50.7	262 26.2	04.9	220 11.1	62	26 41.2	33
23	123 44.9	118 22.1	03.0	122 55.3	10.1	82 56.7	50.8	277 28.7	04.9	234 36.3	62	26 44.5	32
24	138 47.3	133 22.5	+ 4 04.3	137 56.0	− 0 09.3	97 58.9	+14 50.9	292 31.1	− 8 04.9	249 01.5	60	−26 47.7	30
code	—	+ 4	+ 12	+ 8	+ 8	+ 22	+ 1	+ 25	0				

GMT	h	SUN GHA ° ′	Dec. ° ′
6	0	176 28.1	−15 46.4
	1	191 28.1	46.6
	2	206 28.0	44.9
	3	221 28.0	44.1
	4	236 27.9	43.3
	5	251 27.9	42.6
	6	266 27.8	−15 41.8
	7	281 27.8	41.0
	8	296 27.7	40.3
	9	311 27.7	39.5
	10	326 27.7	38.7
	11	341 27.6	37.9
	12	356 27.6	−15 37.2
	13	11 27.5	36.4
	14	26 27.5	35.6
	15	41 27.5	34.9
	16	56 27.4	34.1
	17	71 27.4	33.3
	18	86 27.3	−15 32.5
	19	101 27.3	31.8
	20	116 27.3	31.0
	21	131 27.2	30.2
	22	146 27.2	29.4
	23	161 27.1	28.7
7	0	176 27.1	−15 27.9
	1	191 27.1	27.1
	2	206 27.0	26.3
	3	221 27.0	25.6
	4	236 27.0	24.8
	5	251 26.9	24.0
	6	266 26.9	−15 23.2
	7	281 26.9	22.5
	8	296 26.8	21.7
	9	311 26.8	20.9
	10	326 26.8	20.1
	11	341 26.7	19.3
	12	356 26.7	−15 18.6
	13	11 26.7	17.8
	14	26 26.6	17.0
	15	41 26.6	16.2
	16	56 26.6	15.4
	17	71 26.5	14.6
	18	86 26.5	−15 13.9
	19	101 26.5	13.1
	20	116 26.4	12.3
	21	131 26.4	11.5
	22	146 26.4	10.7
	23	161 26.4	09.9
8	0	176 26.3	−15 09.1
	1	191 26.3	08.4
	2	206 26.3	07.6
	3	221 26.2	06.8
	4	236 26.2	06.0
	5	251 26.2	05.2
	6	266 26.2	−15 04.4
	7	281 26.1	03.6
	8	296 26.1	02.8
	9	311 26.1	02.0
	10	326 26.1	01.2
	11	341 26.0	15 00.5
	12	356 26.0	−14 59.7
	13	11 26.0	58.9
	14	26 26.0	58.1
	15	41 25.9	57.3
	16	56 25.9	56.5
	17	71 25.9	55.7
	18	86 25.9	−14 54.9
	19	101 25.8	54.1
	20	116 25.8	53.3
	21	131 25.8	52.5
	22	146 25.8	51.7
	23	161 25.8	50.9
	24	176 25.7	−14 50.1
	code	−	+ 8

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.6	−40 29.7
5	Achernar	336 00.4	−57 28.6
30	Acrux	173 59.8	−62 50.3
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.2	+16 25.1
32	Alioth	166 59.8	+56 12.5
34	Alkaid	153 34.1	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.3	+26 51.9
1	Alpheratz	358 30.7	+28 50.0
51	Altair	62 52.7	+ 8 44.4
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 22.0	−26 19.9
37	Arcturus	146 36.9	+19 25.2
43	Atria	109 04.8	−68 56.6
22	Avior	234 36.1	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 15.9	−52 40.3
12	Capella	281 41.2	+45 57.4
53	Deneb	50 02.9	+45 06.6
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.2	+62 00.0
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.5	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.3	−56 51.0
29	Gienah	176 38.7	−17 17.0
35	Hadar	149 52.3	−60 08.8
6	Hamal	328 52.0	+23 14.7
48	Kaus Aust.	84 44.1	−34 24.6
40	Kochab	137 17.4	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.0	−36 08.4
24	Miapl'dus	221 48.8	−69 31.4
9	Mirfak	309 45.3	+49 42.1
50	Nunki	76 54.7	−26 21.5
52	Peacock	54 30.9	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.7	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.8	−60 38.6
44	Sabik	103 04.7	−15 40.3
3	Schedar	350 32.8	+56 17.1
45	Shaula	97 23.7	−37 04.3
18	Sirius	259 13.3	−16 39.1
33	Spica	159 18.9	−10 55.2
23	Suhail	223 25.4	−43 14.6
49	Vega	81 10.0	+38 44.0
39	Zub'g'bi	137 55.6	−15 51.0

GMT	Equation of Time (App.—Mean) 6	7	8
h	m s	m s	m s
0	−14 07.5	−14 11.5	−14 14.6
6	−14 08.6	−14 12.3	−14 15.3
12	−14 09.6	−14 13.2	−14 15.9
18	−14 10.6	−14 13.9	−14 16.5
24	−14 11.5	−14 14.6	−14 17.0

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 6 h m	7 h m	8 h m	9 h m
72	9 44	5 33	▬	▬	▬	▬
70	9 15	5 35	3 21	▬	▬	▬
68	8 53	5 36	2 36	▬	▬	▬
66	8 36	5 37	2 06	4 21	▬	▬
64	8 22	5 38	1 44	3 36	5 58	▬
62	8 10	5 38	1 27	3 07	4 55	6 40
60	8 00	5 38	1 12	2 45	4 21	5 49
58	7 51	5 37	1 00	2 28	3 56	5 17
56	7 43	5 37	0 50	2 13	3 36	4 54
54	7 37	5 37	0 40	2 00	3 20	4 34
52	7 30	5 36	0 32	1 49	3 06	4 18
50	7 25	5 36	0 25	1 39	2 53	4 04
45	7 13	5 34	0 09	1 18	2 28	3 36
40	7 03	5 32	25 01	1 01	2 08	3 13
35	6 54	5 29	24 47	0 47	1 51	2 55
30	6 47	5 26	24 35	0 35	1 37	2 39
20	6 33	5 19	24 14	0 14	1 12	2 12
10	6 22	5 10	23 56	24 51	0 51	1 49
0	6 11	5 00	23 40	24 32	0 32	1 28
10	6 00	4 46	23 23	24 12	0 12	1 07
20	5 48	4 29	23 06	23 51	24 44	0 44
30	5 34	4 06	22 46	23 28	24 18	0 18
35	5 26	3 50	22 34	23 14	24 02	0 02
40	5 16	3 31	22 21	22 57	23 44	24 42
45	5 05	3 06	22 05	22 38	23 22	24 19
50	4 52	2 29	21 46	22 15	22 55	23 51
52	4 46	2 09	21 36	22 03	22 42	23 37
54	4 39	1 41	21 26	21 50	22 26	23 21
56	4 31	0 54	21 15	21 35	22 08	23 02
58	4 23	////	21 02	21 18	21 47	22 38
60	4 13	////	20 47	20 57	21 19	22 07

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 6 h m	7 h m	8 h m	9 h m
72	14 46	19 01	▬	▬	▬	▬
70	15 15	18 58	6 27	▬	▬	▬
68	15 37	18 57	7 14	▬	▬	▬
66	15 54	18 55	7 45	7 10	▬	▬
64	16 08	18 54	8 08	7 55	7 24	▬
62	16 20	18 54	8 26	8 25	8 27	8 41
60	16 30	18 54	8 41	8 48	9 01	9 33
58	16 38	18 53	8 54	9 06	9 27	10 04
56	16 46	18 54	9 06	9 21	9 47	10 28
54	16 53	18 54	9 16	9 35	10 04	10 48
52	16 59	18 54	9 24	9 47	10 18	11 04
50	17 04	18 54	9 32	9 57	10 31	11 18
45	17 16	18 56	9 50	10 19	10 57	11 47
40	17 26	18 58	10 04	10 37	11 18	12 09
35	17 35	19 01	10 16	10 51	11 35	12 28
30	17 42	19 03	10 26	11 04	11 50	12 44
20	17 55	19 10	10 44	11 27	12 15	13 11
10	18 07	19 19	11 00	11 46	12 37	13 35
0	18 18	19 29	11 15	12 04	12 58	13 56
10	18 29	19 42	11 29	12 22	13 19	14 18
20	18 41	19 59	11 45	12 42	13 41	14 41
30	18 54	20 21	12 04	13 04	14 06	15 08
35	19 02	20 36	12 15	13 17	14 22	15 24
40	19 11	20 55	12 27	13 33	14 39	15 43
45	19 22	21 19	12 42	13 51	15 00	16 05
50	19 35	21 54	13 00	14 14	15 27	16 34
52	19 41	22 14	13 08	14 25	15 40	16 47
54	19 48	22 40	13 18	14 38	15 55	17 04
56	19 56	23 21	13 29	14 52	16 13	17 23
58	20 04	////	13 41	15 09	16 35	17 46
60	20 14	////	13 56	15 30	17 02	18 17

GMT of Transit
Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
6	5 03	15 08	14 51	17 36	4 41
7	5 52	15 07	14 50	17 33	4 37
8	6 45	15 07	14 49	17 29	4 33
9	7 42	15 06	14 48	17 26	4 29

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.2	0.1
30	0.5	0.2	0.1
45	0.5	0.1	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb
Add

Alt. °	6 ′	7 ′	8 ′
0	13.8	14.8	15.8
4	13.8	14.8	15.8
8	13.8	14.8	15.8
12	13.8	14.8	15.8
16	13.8	14.8	15.8
20	13.9	14.8	15.8
24	13.9	14.8	15.8
28	14.0	14.9	15.8
32	14.0	14.9	15.8
36	14.1	14.9	15.8
40	14.1	14.9	15.8
44	14.2	15.0	15.7
48	14.3	15.0	15.7
52	14.3	15.0	15.7
56	14.4	15.1	15.7
60	14.5	15.1	15.7
64	14.6	15.1	15.7
68	14.7	15.2	15.7
72	14.8	15.2	15.7
76	14.9	15.3	15.6
80	15.0	15.3	15.6
84	15.1	15.3	15.6
88	15.1	15.4	15.6
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt. °	6 ′	7 ′	8 ′
0	16.6	16.0	15.4
4	16.6	16.0	15.4
8	16.5	16.0	15.4
12	16.5	16.0	15.4
16	16.5	16.0	15.4
20	16.5	15.9	15.4
24	16.4	15.9	15.4
28	16.4	15.9	15.4
32	16.3	15.9	15.4
36	16.3	15.9	15.4
40	16.2	15.8	15.5
44	16.1	15.8	15.5
48	16.1	15.8	15.5
52	16.0	15.7	15.5
56	15.9	15.7	15.5
60	15.8	15.7	15.5
64	15.7	15.6	15.5
68	15.6	15.6	15.5
72	15.6	15.6	15.6
76	15.5	15.5	15.6
80	15.4	15.5	15.6
84	15.3	15.4	15.6
88	15.2	15.4	15.6
90			

Subtract from table, back cover

Last Quarter 7

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
9 0	138 47.3	133 22.5	+ 4 04.3	137 56.0	− 0 09.3	97 58.9	+14 50.9	292 31.1	− 8 04.9	249 01.5	60	−26 47.7	− 30
1	153 49.8	148 22.9	05.5	152 56.8	08.5	113 01.1	51.0	307 33.6	04.9	263 26.5	59	26 50.7	− 29
2	168 52.3	163 23.3	06.7	167 57.5	07.8	128 03.3	51.0	322 36.1	04.9	277 51.4	59	26 53.6	− 27
3	183 54.7	178 23.7	•• 07.9	182 58.2	•• 07.0	143 05.5	•• 51.1	337 38.6	•• 04.8	292 16.3	58	•26 56.3	− 25
4	198 57.2	193 24.1	09.1	197 59.0	06.2	158 07.7	51.2	352 41.1	04.8	306 41.1	56	26 58.8	− 24
5	213 59.6	208 24.5	10.3	212 59.7	05.4	173 09.9	51.3	7 43.5	04.8	321 05.7	57	27 01.2	− 22
6	229 02.1	223 24.9	+ 4 11.5	228 00.5	− 0 04.6	188 12.1	+14 51.4	22 46.0	− 8 04.8	335 30.4	55	−27 03.4	− 21
7	244 04.6	238 25.4	12.7	243 01.2	03.8	203 14.3	51.5	37 48.5	04.8	349 54.9	54	27 05.5	− 19
8	259 07.0	253 25.8	13.9	258 01.9	03.1	218 16.5	51.6	52 51.0	04.8	4 19.3	54	27 07.4	− 17
9	274 09.5	268 26.2	•• 15.1	273 02.7	•• 02.3	233 18.7	•• 51.7	67 53.4	•• 04.7	18 43.7	53	•27 09.1	− 15
10	289 12.0	283 26.6	16.3	288 03.4	01.5	248 20.9	51.8	82 55.9	04.7	33 08.0	53	27 10.6	− 14
11	304 14.4	298 27.0	17.5	303 04.2	− 0 00.7	263 23.0	51.9	97 58.4	04.7	47 32.3	51	27 12.0	− 12
12	319 16.9	313 27.4	+ 4 18.7	318 04.9	+ 0 00.1	278 25.2	+14 52.0	113 00.9	− 8 04.7	61 56.4	51	−27 13.2	− 10
13	334 19.4	328 27.9	19.9	333 05.6	00.9	293 27.4	52.1	128 03.4	04.7	76 20.5	50	27 14.2	− 9
14	349 21.8	343 28.3	21.1	348 06.4	01.7	308 29.6	52.2	143 05.8	04.6	90 44.5	50	27 15.1	− 7
15	4 24.3	358 28.7	•• 22.3	3 07.1	•• 02.4	323 31.8	•• 52.3	158 08.3	•• 04.6	105 08.5	49	•27 15.8	− 5
16	19 26.8	13 29.1	23.5	18 07.9	03.2	338 34.0	52.4	173 10.8	04.6	119 32.4	48	27 16.3	− 3
17	34 29.2	28 29.5	24.8	33 08.6	04.0	353 36.2	52.5	188 13.3	04.6	133 56.2	48	27 16.6	− 2
18	49 31.7	43 30.0	+ 4 26.0	48 09.3	+ 0 04.8	8 38.4	+14 52.5	203 15.7	− 8 04.6	148 20.0	47	−27 16.8	0
19	64 34.1	58 30.4	27.2	63 10.1	05.6	23 40.6	52.6	218 18.2	04.6	162 43.7	47	27 16.8	+ 2
20	79 36.6	73 30.8	28.4	78 10.8	06.4	38 42.8	52.7	233 20.7	04.5	177 07.4	46	27 16.6	+ 4
21	94 39.1	88 31.2	•• 29.6	93 11.6	•• 07.1	53 45.0	•• 52.8	248 23.2	•• 04.5	191 31.0	45	•27 16.2	+ 6
22	109 41.5	103 31.7	30.8	108 12.3	07.9	68 47.1	52.9	263 25.7	04.5	205 54.5	45	27 15.6	+ 7
23	124 44.0	118 32.1	32.0	123 13.0	08.7	83 49.3	53.0	278 28.1	04.5	220 18.0	45	27 14.9	+ 9
10 0	139 46.5	133 32.5	+ 4 33.2	138 13.8	+ 0 09.5	98 51.5	+14 53.1	293 30.6	− 8 04.5	234 41.5	44	−27 14.0	+ 11
1	154 48.9	148 32.9	34.4	153 14.5	10.3	113 53.7	53.2	308 33.1	04.5	249 04.9	44	27 12.9	+ 13
2	169 51.4	163 33.4	35.6	168 15.3	11.1	128 55.9	53.3	323 35.6	04.4	263 28.3	43	27 11.6	+ 15
3	184 53.9	178 33.8	•• 36.8	183 16.0	•• 11.9	143 58.1	•• 53.4	338 38.1	•• 04.4	277 51.6	43	•27 10.1	+ 16
4	199 56.3	193 34.2	38.0	198 16.7	12.6	159 00.3	53.5	353 40.5	04.4	292 14.9	43	27 08.5	+ 18
5	214 58.8	208 34.7	39.2	213 17.5	13.4	174 02.5	53.6	8 43.0	04.4	306 38.2	42	27 06.7	+ 21
6	230 01.3	223 35.1	+ 4 40.4	228 18.2	+ 0 14.2	189 04.7	+14 53.7	23 45.5	− 8 04.4	321 01.4	42	−27 04.6	+ 22
7	245 03.7	238 35.5	41.6	243 19.0	15.0	204 06.8	53.8	38 48.0	04.3	335 24.6	41	27 02.4	+ 24
8	260 06.2	253 36.0	42.8	258 19.7	15.8	219 09.0	53.9	53 50.5	04.3	349 47.7	42	27 00.0	+ 25
9	275 08.6	268 36.4	•• 44.0	273 20.4	•• 16.6	234 11.2	•• 54.0	68 53.0	•• 04.3	4 10.9	41	•26 57.5	+ 28
10	290 11.1	283 36.8	45.2	288 21.2	17.3	249 13.4	54.1	83 55.4	04.3	18 34.0	41	26 54.7	+ 29
11	305 13.6	298 37.3	46.4	303 21.9	18.1	264 15.6	54.2	98 57.9	04.3	32 57.1	40	26 51.8	+ 32
12	320 16.0	313 37.7	+ 4 47.6	318 22.7	+ 0 18.9	279 17.8	+14 54.3	114 00.4	− 8 04.3	47 20.1	41	−26 48.6	+ 33
13	335 18.5	328 38.2	48.8	333 23.4	19.7	294 20.0	54.4	129 02.9	04.2	61 43.2	40	26 45.3	+ 35
14	350 21.0	343 38.6	50.0	348 24.2	20.5	309 22.1	54.5	144 05.4	04.2	76 06.2	40	26 41.8	+ 37
15	5 23.4	358 39.0	•• 51.2	3 24.9	•• 21.3	324 24.3	•• 54.6	159 07.9	•• 04.2	90 29.2	40	•26 38.1	+ 38
16	20 25.9	13 39.5	52.4	18 25.6	22.0	339 26.5	54.6	174 10.3	04.2	104 52.2	40	26 34.3	+ 41
17	35 28.4	28 39.9	53.5	33 26.4	22.8	354 28.7	54.7	189 12.8	04.2	119 15.2	40	26 30.2	+ 43
18	50 30.8	43 40.4	+ 4 54.7	48 27.1	+ 0 23.6	9 30.9	+14 54.8	204 15.3	− 8 04.1	133 38.2	40	−26 25.9	+ 44
19	65 33.3	58 40.8	55.9	63 27.9	24.4	24 33.1	54.9	219 17.8	04.1	148 01.2	40	26 21.5	+ 46
20	80 35.8	73 41.3	57.1	78 28.6	25.2	39 35.3	55.0	234 20.3	04.1	162 24.2	40	26 16.9	+ 48
21	95 38.2	88 41.7	•• 58.3	93 29.3	•• 26.0	54 37.4	•• 55.1	249 22.8	•• 04.1	176 47.2	40	•26 12.1	+ 50
22	110 40.7	103 42.2	4 59.5	108 30.1	26.7	69 39.6	55.2	264 25.2	04.1	191 10.2	39	26 07.1	+ 52
23	125 43.1	118 42.6	5 00.7	123 30.8	27.5	84 41.8	55.3	279 27.7	04.0	205 33.1	40	26 01.9	+ 54
11 0	140 45.6	133 43.1	+ 5 01.9	138 31.6	+ 0 28.3	99 44.0	+14 55.4	294 30.2	− 8 04.0	219 56.1	40	−25 56.5	+ 55
1	155 48.1	148 43.5	03.1	153 32.3	29.1	114 46.2	55.5	309 32.7	04.0	234 19.1	41	25 51.0	+ 58
2	170 50.5	163 44.0	04.3	168 33.1	29.9	129 48.4	55.6	324 35.2	04.0	248 42.2	40	25 45.2	+ 59
3	185 53.0	178 44.4	•• 05.5	183 33.8	•• 30.7	144 50.5	•• 55.7	339 37.7	•• 04.0	263 05.2	40	•25 39.3	+ 61
4	200 55.5	193 44.9	06.7	198 34.5	31.4	159 52.7	55.8	354 40.1	03.9	277 28.2	41	25 33.2	+ 63
5	215 57.9	208 45.3	07.9	213 35.3	32.2	174 54.9	55.9	9 42.6	03.9	291 51.3	40	25 26.9	+ 65
6	231 00.4	223 45.8	+ 5 09.1	228 36.0	+ 0 33.0	189 57.1	+14 56.0	24 45.1	− 8 03.9	306 14.3	41	−25 20.4	+ 66
7	246 02.9	238 46.2	10.3	243 36.8	33.8	204 59.3	56.1	39 47.6	03.9	320 37.4	42	25 13.8	+ 68
8	261 05.3	253 46.7	11.5	258 37.5	34.6	220 01.4	56.2	54 50.1	03.9	335 00.6	41	25 07.0	+ 71
9	276 07.8	268 47.1	•• 12.6	273 38.2	•• 35.4	235 03.6	•• 56.3	69 52.6	•• 03.8	349 23.7	42	•24 59.9	+ 72
10	291 10.2	283 47.6	13.8	288 39.0	36.1	250 05.8	56.4	84 55.1	03.8	3 46.9	42	24 52.7	+ 74
11	306 12.7	298 48.1	15.0	303 39.7	36.9	265 08.0	56.5	99 57.5	03.8	18 10.1	42	24 45.3	+ 75
12	321 15.2	313 48.5	+ 5 16.2	318 40.5	+ 0 37.7	280 10.2	+14 56.6	115 00.0	− 8 03.8	32 33.3	43	−24 37.8	+ 78
13	336 17.6	328 49.0	17.4	333 41.2	38.5	295 12.3	56.7	130 02.5	03.8	46 56.6	43	24 30.0	+ 79
14	351 20.1	343 49.5	18.6	348 42.0	39.3	310 14.5	56.8	145 05.0	03.7	61 19.9	43	24 22.1	+ 81
15	6 22.6	358 49.9	•• 19.8	3 42.7	•• 40.1	325 16.7	•• 56.9	160 07.5	•• 03.7	75 43.2	43	•24 14.0	+ 82
16	21 25.0	13 50.4	21.0	18 43.4	40.8	340 18.9	57.0	175 10.0	03.7	90 06.5	45	24 05.8	+ 85
17	36 27.5	28 50.8	22.2	33 44.2	41.6	355 21.0	57.1	190 12.5	03.7	104 30.0	44	23 57.3	+ 86
18	51 30.0	43 51.3	+ 5 23.3	48 44.9	+ 0 42.4	10 23.2	+14 57.2	205 15.0	− 8 03.7	118 53.4	45	−23 48.7	+ 88
19	66 32.4	58 51.8	24.5	63 45.7	43.2	25 25.4	57.3	220 17.4	03.6	133 16.9	45	23 39.9	+ 90
20	81 34.9	73 52.2	25.7	78 46.4	44.0	40 27.6	57.4	235 19.9	03.6	147 40.4	46	23 30.9	+ 91
21	96 37.4	88 52.7	•• 26.9	93 47.2	•• 44.8	55 29.8	•• 57.5	250 22.4	•• 03.6	162 04.0	46	•23 21.8	+ 93
22	111 39.8	103 53.2	28.1	108 47.9	45.5	70 31.9	57.6	265 24.9	03.6	176 27.6	47	23 12.5	+ 95
23	126 42.3	118 53.7	29.3	123 48.6	46.3	85 34.1	57.7	280 27.4	03.6	190 51.3	47	23 03.0	+ 96
24	141 44.7	133 54.1	+ 5 30.5	138 49.4	+ 0 47.1	100 36.3	+14 57.8	295 29.9	− 8 03.5	205 15.0	48	−22 53.4	+ 99
code	−	+ 5	+ 12	+ 7	+ 8	+ 22	+ 1	+ 25	+ 1			−	

GMT	SUN GHA	SUN Dec.
9 h 0	176 25.7	−14 50.1
1	191 25.7	49.3
2	206 25.7	48.5
3	221 25.7	47.7
4	236 25.7	46.9
5	251 25.6	46.1
6	266 25.6	−14 45.3
7	281 25.6	44.5
8	296 25.6	43.7
9	311 25.6	42.9
10	326 25.5	42.1
11	341 25.5	41.3
12	356 25.5	−14 40.5
13	11 25.5	39.7
14	26 25.5	38.9
15	41 25.5	38.1
16	56 25.4	37.3
17	71 25.4	36.5
18	86 25.4	−14 35.7
19	101 25.4	34.9
20	116 25.4	34.1
21	131 25.4	33.3
22	146 25.4	32.5
23	161 25.3	31.7
10 h 0	176 25.3	−14 30.9
1	191 25.3	30.1
2	206 25.3	29.2
3	221 25.3	28.4
4	236 25.3	27.6
5	251 25.3	26.8
6	266 25.3	−14 26.0
7	281 25.3	25.2
8	296 25.2	24.4
9	311 25.2	23.6
10	326 25.2	22.8
11	341 25.2	21.9
12	356 25.2	−14 21.1
13	11 25.2	20.3
14	26 25.2	19.5
15	41 25.2	18.7
16	56 25.2	17.9
17	71 25.2	17.1
18	86 25.2	−14 16.3
19	101 25.1	15.4
20	116 25.1	14.6
21	131 25.1	13.8
22	146 25.1	13.0
23	161 25.1	12.2
11 h 0	176 25.1	−14 11.4
1	191 25.1	10.5
2	206 25.1	09.7
3	221 25.1	08.9
4	236 25.1	08.1
5	251 25.1	07.3
6	266 25.1	−14 06.4
7	281 25.1	05.6
8	296 25.1	04.8
9	311 25.1	04.0
10	326 25.1	03.2
11	341 25.1	02.3
12	356 25.1	−14 01.5
13	11 25.1	14 00.7
14	26 25.1	13 59.9
15	41 25.1	59.0
16	56 25.1	58.2
17	71 25.1	57.4
18	86 25.1	−13 56.6
19	101 25.1	55.7
20	116 25.1	54.9
21	131 25.1	54.1
22	146 25.1	53.3
23	161 25.1	52.4
24	176 25.1	−13 51.6
code	−	+ 8

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.6	−40 29.7
5	Achernar	336 00.4	−57 28.6
30	Acrux	173 59.8	−62 50.3
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.8	+56 12.5
34	Alkaid	153 34.1	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.3	+26 51.9
1	Alpheratz	358 30.7	+28 50.0
51	Altair	62 52.7	+ 8 44.4
2	Ankaa	354 00.4	−42 33.8
42	Antares	113 21.9	−26 19.9
37	Arcturus	146 36.9	+19 25.2
43	Atria	109 04.8	−68 56.6
22	Avior	234 36.1	−59 21.6
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 15.9	−52 40.3
12	Capella	281 41.2	+45 57.4
53	Deneb	50 02.9	+45 06.6
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.2	+62 00.0
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.5	+51 29.3
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.3	−56 51.0
29	Gienah	176 38.7	−17 17.0
35	Hadar	149 52.2	−60 08.8
6	Hamal	328 52.1	+23 14.7
48	Kaus Aust.	84 44.1	−34 24.6
40	Kochab	137 17.3	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.0	−36 08.4
24	Miapl'dus	221 48.8	−69 31.5
9	Mirfak	309 45.3	+49 42.1
50	Nunki	76 54.6	−26 21.5
52	Peacock	54 30.9	−56 53.3
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.6	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.8	−60 38.6
44	Sabik	103 04.6	−15 40.3
3	Schedar	350 32.8	+56 17.1
45	Shaula	97 23.6	−37 04.3
18	Sirius	259 13.3	−16 39.1
33	Spica	159 18.9	−10 55.2
23	Suhail	223 25.4	−43 14.6
49	Vega	81 09.9	+38 44.0
39	Zub'g'bi	137 55.6	−15 51.0

GMT	Equation of Time (App.—Mean) 9	10	11
h	m s	m s	m s
0	−14 17.0	−14 18.7	−14 19.5
6	−14 17.5	−14 18.9	−14 19.6
12	−14 17.9	−14 19.2	−14 19.7
18	−14 18.3	−14 19.4	−14 19.7
24	−14 18.7	−14 19.5	−14 19.6

Lat. N	Sunrise	Twlt. begins	Moonrise 9	10	11	12
°	h m	h m	h m	h m	h m	h m
72	9 25	5 22	▬	▬	▬	▬
70	8 59	5 24	▬	▬	▬	▬
68	8 40	5 27	▬	▬	▬	9 43
66	8 25	5 29	▬	▬	▬	8 50
64	8 12	5 30	▬	▬	8 40	8 16
62	8 01	5 31	6 40	7 39	7 50	7 52
60	7 52	5 32	5 49	6 49	7 19	7 32
58	7 44	5 33	5 17	6 18	6 55	7 16
56	7 37	5 32	4 54	5 55	6 36	7 02
54	7 31	5 32	4 34	5 36	6 20	6 50
52	7 25	5 32	4 18	5 19	6 06	6 39
50	7 20	5 32	4 04	5 05	5 54	6 30
45	7 09	5 30	3 36	4 37	5 28	6 09
40	6 59	5 29	3 13	4 14	5 08	5 53
35	6 51	5 26	2 55	3 56	4 51	5 39
30	6 44	5 24	2 39	3 40	4 36	5 27
20	6 32	5 18	2 12	3 13	4 11	5 06
10	6 21	5 09	1 49	2 50	3 50	4 48
0	6 11	5 00	1 28	2 28	3 30	4 31
10	6 01	4 47	1 07	2 06	3 09	4 13
20	5 49	4 31	0 44	1 43	2 48	3 55
30	5 36	4 09	0 18	1 16	2 22	3 34
35	5 29	3 55	0 02	1 00	2 07	3 21
40	5 20	3 36	24 42	0 42	1 50	3 07
45	5 10	3 12	24 19	0 19	1 29	2 49
50	4 57	2 39	23 51	25 03	1 03	2 28
52	4 52	2 21	23 37	24 50	0 50	2 18
54	4 45	1 57	23 21	24 36	0 36	2 06
56	4 38	1 23	23 02	24 19	0 19	1 53
58	4 30	////	22 38	23 58	25 38	1 38
60	4 21	////	22 07	23 31	25 19	1 19
S						

Lat. N	Sunset	Twlt. ends	Moonset 9	10	11	12
°	h m	h m	h m	h m	h m	h m
72	15 05	19 12	▬	▬	▬	▬
70	15 31	19 09	▬	▬	▬	▬
68	15 50	19 06	▬	▬	▬	12 04
66	16 05	19 04	▬	▬	▬	12 57
64	16 18	19 03	▬	▬	10 58	13 29
62	16 28	19 01	8 41	9 50	11 48	13 53
60	16 38	19 01	9 33	10 39	12 18	14 11
58	16 45	18 59	10 04	11 10	12 42	14 27
56	16 52	18 59	10 28	11 33	13 00	14 40
54	16 59	18 59	10 48	11 52	13 16	14 51
52	17 04	18 59	11 04	12 08	13 30	15 01
50	17 09	18 59	11 18	12 22	13 42	15 10
45	17 21	19 00	11 47	12 50	14 06	15 29
40	17 30	19 02	12 09	13 13	14 26	15 44
35	17 38	19 04	12 28	13 31	14 42	15 57
30	17 45	19 06	12 44	13 47	14 56	16 08
20	17 57	19 12	13 11	14 13	15 19	16 27
10	18 08	19 20	13 35	14 36	15 40	16 44
0	18 18	19 29	13 56	14 57	15 59	16 59
10	18 28	19 41	14 18	15 18	16 18	17 14
20	18 39	19 56	14 41	15 41	16 38	17 30
30	18 52	20 18	15 08	16 07	17 01	17 48
35	19 00	20 33	15 24	16 22	17 14	17 59
40	19 08	20 50	15 43	16 40	17 29	18 11
45	19 18	21 13	16 05	17 02	17 48	18 25
50	19 30	21 46	16 34	17 28	18 10	18 42
52	19 36	22 04	16 47	17 41	18 21	18 50
54	19 42	22 26	17 04	17 56	18 33	18 58
56	19 50	22 59	17 23	18 14	18 47	19 08
58	19 57	////	17 46	18 35	19 03	19 20
60	20 06	////	18 17	19 02	19 22	19 32
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
9	7 42	15 06	14 48	17 26	4 29
10	8 43	15 05	14 46	17 22	4 25
11	9 44	15 05	14 45	17 19	4 21
12	10 45	15 04	14 44	17 15	4 17

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.2	0.1
30	0.5	0.2	0.1
45	0.5	0.1	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	9	10	11
°	′	′	′
0	17.1	18.3	19.5
4	17.1	18.3	19.5
8	17.1	18.3	19.5
12	17.0	18.3	19.4
16	17.0	18.2	19.3
20	17.0	18.2	19.3
24	17.0	18.1	19.2
28	16.9	18.1	19.1
32	16.9	18.0	19.0
36	16.8	17.9	18.8
40	16.8	17.8	18.7
44	16.7	17.7	18.5
48	16.6	17.6	18.4
52	16.6	17.4	18.2
56	16.5	17.3	18.0
60	16.4	17.2	17.9
64	16.4	17.0	17.7
68	16.3	16.9	17.5
72	16.2	16.8	17.2
76	16.1	16.6	17.0
80	16.0	16.5	16.8
84	16.0	16.3	16.6
88	15.9	16.2	16.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	9	10	11
°	′	′	′
0	14.7	14.0	13.3
4	14.7	14.0	13.3
8	14.7	14.0	13.3
12	14.7	14.0	13.4
16	14.7	14.1	13.4
20	14.8	14.1	13.5
24	14.8	14.2	13.6
28	14.8	14.2	13.7
32	14.9	14.3	13.8
36	14.9	14.4	14.0
40	15.0	14.5	14.1
44	15.0	14.6	14.2
48	15.1	14.7	14.4
52	15.2	14.9	14.6
56	15.2	15.0	14.8
60	15.3	15.1	14.9
64	15.4	15.3	15.1
68	15.5	15.4	15.3
72	15.5	15.5	15.5
76	15.6	15.7	15.7
80	15.7	15.8	16.0
84	15.8	16.0	16.2
88	15.9	16.1	16.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
12 0	141 44.7	133 54.1	+ 5 30.5	138 49.4	+ 0 47.1	100 36.3	+14 57.8	295 29.9	− 8 03.5	205 15.0	48	−22 53.4	+ 99
1	156 47.2	148 54.6	31.7	153 50.1	47.9	115 38.5	57.9	310 32.4	03.5	219 38.8	48	22 43.5	+ 99
2	171 49.7	163 55.1	32.8	168 50.9	48.7	130 40.6	58.0	325 34.9	03.5	234 02.6	49	22 33.6	+102
3	186 52.1	178 55.6	·· 34.0	183 51.6	·· 49.4	145 42.8	·· 58.1	340 37.4	·· 03.5	248 26.5	49	·22 23.4	+103
4	201 54.6	193 56.0	35.2	198 52.4	50.2	160 45.0	58.2	355 39.8	03.4	262 50.4	50	22 13.1	+104
5	216 57.1	208 56.5	36.4	213 53.1	51.0	175 47.2	58.3	10 42.3	03.4	277 14.4	51	22 02.7	+107
6	231 59.5	223 57.0	+ 5 37.6	228 53.8	+ 0 51.8	190 49.3	+14 58.4	25 44.8	− 8 03.4	291 38.5	51	−21 52.0	+107
7	247 02.0	238 57.5	38.8	243 54.6	52.6	205 51.5	58.5	40 47.3	03.4	306 02.6	51	21 41.3	+110
8	262 04.5	253 57.9	39.9	258 55.3	53.4	220 53.7	58.6	55 49.8	03.4	320 26.7	53	21 30.3	+111
9	277 06.9	268 58.4	·· 41.1	273 56.1	·· 54.1	235 55.9	·· 58.7	70 52.3	·· 03.3	334 51.0	52	·21 19.2	+112
10	292 09.4	283 58.9	42.3	288 56.8	54.9	250 58.0	58.8	85 54.8	03.3	349 15.2	54	21 08.0	+114
11	307 11.9	298 59.4	43.5	303 57.6	55.7	266 00.2	58.9	100 57.3	03.3	3 39.6	54	20 56.6	+116
12	322 14.3	313 59.9	+ 5 44.7	318 58.3	+ 0 56.5	281 02.4	+14 59.0	115 59.8	− 8 03.3	18 04.0	55	−20 45.0	+117
13	337 16.8	329 00.4	45.8	333 59.0	57.3	296 04.5	59.1	131 02.3	03.3	32 28.5	55	20 33.3	+119
14	352 19.2	344 00.8	47.0	348 59.8	58.1	311 06.7	59.2	146 04.8	03.2	46 53.0	56	20 21.4	+120
15	7 21.7	359 01.3	·· 48.2	4 00.5	·· 58.8	326 08.9	·· 59.3	161 07.2	·· 03.2	61 17.6	57	·20 09.4	+121
16	22 24.2	14 01.8	49.4	19 01.3	0 59.6	341 11.1	59.4	176 09.7	03.2	75 42.3	57	19 57.3	+123
17	37 26.6	29 02.3	50.6	34 02.0	1 00.4	356 13.2	59.5	191 12.2	03.2	90 07.0	58	19 45.0	+124
18	52 29.1	44 02.8	+ 5 51.7	49 02.8	+ 1 01.2	11 15.4	+14 59.6	206 14.7	− 8 03.1	104 31.8	59	−19 32.6	+126
19	67 31.6	59 03.3	52.9	64 03.5	02.0	26 17.6	59.7	221 17.2	03.1	118 56.7	59	19 20.0	+127
20	82 34.0	74 03.8	54.1	79 04.2	02.7	41 19.7	59.8	236 19.7	03.1	133 21.6	61	19 07.3	+128
21	97 36.5	89 04.3	·· 55.3	94 05.0	·· 03.5	56 21.9	·14 59.9	251 22.2	·· 03.1	147 46.7	60	·18 54.5	+130
22	112 39.0	104 04.8	56.5	109 05.7	04.3	71 24.1	15 00.0	266 24.7	03.1	162 11.7	62	18 41.5	+131
23	127 41.4	119 05.3	57.6	124 06.5	05.1	86 26.3	00.1	281 27.2	03.0	176 36.9	62	18 28.4	+132
13 0	142 43.9	134 05.8	+ 5 58.8	139 07.2	+ 1 05.9	101 28.4	+15 00.2	296 29.7	− 8 03.0	191 02.1	63	−18 15.2	+134
1	157 46.4	149 06.3	6 00.0	154 08.0	06.6	116 30.6	00.3	311 32.2	03.0	205 27.4	63	18 01.8	+135
2	172 48.8	164 06.8	01.2	169 08.7	07.4	131 32.8	00.4	326 34.7	03.0	219 52.7	64	17 48.3	+136
3	187 51.3	179 07.3	·· 02.3	184 09.4	·· 08.2	146 34.9	·· 00.5	341 37.2	·· 02.9	234 18.1	65	·17 34.7	+138
4	202 53.7	194 07.8	03.5	199 10.2	09.0	161 37.1	00.6	356 39.6	02.9	248 43.6	66	17 20.9	+138
5	217 56.2	209 08.3	04.7	214 10.9	09.8	176 39.3	00.7	11 42.1	02.9	263 09.2	66	17 07.1	+140
6	232 58.7	224 08.8	+ 6 05.9	229 11.7	+ 1 10.6	191 41.4	+15 00.8	26 44.6	− 8 02.9	277 34.8	67	−16 53.1	+141
7	248 01.1	239 09.3	07.0	244 12.4	11.3	206 43.6	00.9	41 47.1	02.9	292 00.5	68	16 39.0	+142
8	263 03.6	254 09.8	08.2	259 13.2	12.1	221 45.8	01.0	56 49.6	02.8	306 26.3	69	16 24.8	+144
9	278 06.1	269 10.3	·· 09.4	274 13.9	·· 12.9	236 47.9	·· 01.1	71 52.1	·· 02.8	320 52.2	69	·16 10.4	+144
10	293 08.5	284 10.8	10.6	289 14.6	13.7	251 50.1	01.2	86 54.6	02.8	335 18.1	70	15 56.0	+145
11	308 11.0	299 11.3	11.7	304 15.4	14.5	266 52.3	01.3	101 57.1	02.8	349 44.1	70	15 41.5	+147
12	323 13.5	314 11.8	+ 6 12.9	319 16.1	+ 1 15.2	281 54.4	+15 01.4	116 59.6	− 8 02.7	4 10.1	72	−15 26.8	+148
13	338 15.9	329 12.3	14.1	334 16.9	16.0	296 56.6	01.5	132 02.1	02.7	18 36.3	72	15 12.0	+148
14	353 18.4	344 12.8	15.3	349 17.6	16.8	311 58.8	01.6	147 04.6	02.7	33 02.5	72	14 57.2	+150
15	8 20.9	359 13.3	·· 16.4	4 18.4	·· 17.6	327 00.9	·· 01.7	162 07.1	·· 02.7	47 28.7	74	·14 42.2	+151
16	23 23.3	14 13.8	17.6	19 19.1	18.4	342 03.1	01.8	177 09.6	02.6	61 55.1	74	14 27.1	+151
17	38 25.8	29 14.3	18.8	34 19.9	19.1	357 05.3	01.9	192 12.1	02.6	76 21.5	74	14 12.0	+153
18	53 28.2	44 14.8	+ 6 19.9	49 20.6	+ 1 19.9	12 07.4	+15 02.0	207 14.6	− 8 02.6	90 47.9	76	−13 56.7	+153
19	68 30.7	59 15.4	21.1	64 21.3	20.7	27 09.6	02.1	222 17.1	02.6	105 14.5	76	13 41.4	+155
20	83 33.2	74 15.9	22.3	79 22.1	21.5	42 11.8	02.2	237 19.6	02.5	119 41.1	76	13 25.9	+155
21	98 35.6	89 16.4	·· 23.4	94 22.8	·· 22.3	57 13.9	·· 02.3	252 22.1	·· 02.5	134 07.7	78	·13 10.4	+156
22	113 38.1	104 16.9	24.6	109 23.6	23.0	72 16.1	02.4	267 24.6	02.5	148 34.5	78	12 54.8	+157
23	128 40.6	119 17.4	25.8	124 24.3	23.8	87 18.2	02.5	282 27.1	02.5	163 01.3	79	12 39.1	+158
14 0	143 43.0	134 17.9	+ 6 27.0	139 25.1	+ 1 24.6	102 20.4	+15 02.6	297 29.6	− 8 02.5	177 28.2	79	−12 23.3	+159
1	158 45.5	149 18.5	28.1	154 25.8	25.4	117 22.6	02.7	312 32.1	02.4	191 55.1	80	12 07.4	+159
2	173 48.0	164 19.0	29.3	169 26.6	26.2	132 24.7	02.8	327 34.5	02.4	206 22.1	81	11 51.5	+160
3	188 50.4	179 19.5	·· 30.5	184 27.3	·· 26.9	147 26.9	·· 02.9	342 37.0	·· 02.4	220 49.2	81	·11 35.5	+161
4	203 52.9	194 20.0	31.6	199 28.0	27.7	162 29.1	03.0	357 39.5	02.4	235 16.3	82	11 19.4	+162
5	218 55.3	209 20.6	32.8	214 28.8	28.5	177 31.2	03.1	12 42.0	02.3	249 43.5	82	11 03.2	+162
6	233 57.8	224 21.1	+ 6 33.9	229 29.5	+ 1 29.3	192 33.4	+15 03.2	27 44.5	− 8 02.3	264 10.7	83	−10 47.0	+163
7	249 00.3	239 21.6	35.1	244 30.3	30.1	207 35.5	03.3	42 47.0	02.3	278 38.0	84	10 30.7	+164
8	264 02.7	254 22.1	36.3	259 31.0	30.8	222 37.7	03.4	57 49.5	02.3	293 05.4	84	10 14.3	+164
9	279 05.2	269 22.7	·· 37.4	274 31.8	·· 31.6	237 39.9	·· 03.5	72 52.0	·· 02.2	307 32.8	85	· 9 57.9	+165
10	294 07.7	284 23.2	38.6	289 32.5	32.4	252 42.0	03.6	87 54.5	02.2	322 00.3	86	9 41.4	+165
11	309 10.1	299 23.7	39.8	304 33.2	33.2	267 44.2	03.7	102 57.0	02.2	336 27.9	86	9 24.9	+166
12	324 12.6	314 24.3	+ 6 40.9	319 34.0	+ 1 34.0	282 46.3	+15 03.8	117 59.5	− 8 02.2	350 55.5	86	− 9 08.3	+167
13	339 15.1	329 24.8	42.1	334 34.7	34.7	297 48.5	03.9	133 02.0	02.1	5 23.1	87	8 51.6	+167
14	354 17.5	344 25.3	43.3	349 35.5	35.5	312 50.7	04.0	148 04.5	02.1	19 50.8	88	8 34.9	+168
15	9 20.0	359 25.9	·· 44.4	4 36.2	·· 36.3	327 52.8	·· 04.1	163 07.0	·· 02.1	34 18.6	88	· 8 18.1	+168
16	24 22.5	14 26.4	45.6	19 37.0	37.1	342 55.0	04.2	178 09.5	02.1	48 46.4	89	8 01.3	+168
17	39 24.9	29 26.9	46.7	34 37.7	37.9	357 57.1	04.3	193 12.0	02.0	63 14.3	89	7 44.5	+169
18	54 27.4	44 27.5	+ 6 47.9	49 38.5	+ 1 38.6	12 59.3	+15 04.4	208 14.5	− 8 02.0	77 42.2	90	− 7 27.6	+170
19	69 29.8	59 28.0	49.1	64 39.2	39.4	28 01.4	04.5	223 17.0	02.0	92 10.2	90	7 10.6	+169
20	84 32.3	74 28.6	50.2	79 39.9	40.2	43 03.6	04.6	238 19.5	02.0	106 38.2	91	6 53.7	+170
21	99 34.8	89 29.1	·· 51.4	94 40.7	·· 41.0	58 05.8	·· 04.7	253 22.0	·· 01.9	121 06.3	91	· 6 36.7	+171
22	114 37.2	104 29.6	52.5	109 41.4	41.7	73 07.9	04.9	268 24.5	01.9	135 34.4	92	6 19.6	+171
23	129 39.7	119 30.2	53.7	124 42.2	42.5	88 10.1	05.0	283 27.0	01.9	150 02.6	92	6 02.5	+171
24	144 42.2	134 30.7	+ 6 54.9	139 42.9	+ 1 43.3	103 12.2	+15 05.1	298 29.5	− 8 01.9	164 30.8	93	− 5 45.4	+171
code	—	+ 5	+ 12	+ 8	+ 8	+ 22	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
12 0	176 25.1	−13 51.6
1	191 25.1	50.8
2	206 25.1	49.9
3	221 25.1	49.1
4	236 25.1	48.3
5	251 25.1	47.5
6	266 25.1	−13 46.6
7	281 25.1	45.8
8	296 25.1	45.0
9	311 25.1	44.1
10	326 25.1	43.3
11	341 25.2	42.5
12	356 25.2	−13 41.6
13	11 25.2	40.8
14	26 25.2	40.0
15	41 25.2	39.1
16	56 25.2	38.3
17	71 25.2	37.5
18	86 25.2	−13 36.6
19	101 25.2	35.8
20	116 25.2	35.0
21	131 25.2	34.1
22	146 25.2	33.3
23	161 25.3	32.5
13 0	176 25.3	−13 31.6
1	191 25.3	30.8
2	206 25.3	30.0
3	221 25.3	29.1
4	236 25.3	28.3
5	251 25.3	27.4
6	266 25.3	−13 26.6
7	281 25.4	25.8
8	296 25.4	24.9
9	311 25.4	24.1
10	326 25.4	23.2
11	341 25.4	22.4
12	356 25.4	−13 21.6
13	11 25.4	20.7
14	26 25.5	19.9
15	41 25.5	19.0
16	56 25.5	18.2
17	71 25.5	17.3
18	86 25.5	−13 16.5
19	101 25.5	15.7
20	116 25.6	14.8
21	131 25.6	14.0
22	146 25.6	13.1
23	161 25.6	12.3
14 0	176 25.6	−13 11.4
1	191 25.6	10.6
2	206 25.7	09.7
3	221 25.7	08.9
4	236 25.7	08.0
5	251 25.7	07.2
6	266 25.7	−13 06.3
7	281 25.8	05.5
8	296 25.8	04.6
9	311 25.8	03.8
10	326 25.8	03.0
11	341 25.9	02.1
12	356 25.9	−13 01.3
13	11 25.9	13 00.4
14	26 25.9	12 59.5
15	41 25.9	58.7
16	56 26.0	57.8
17	71 26.0	57.0
18	86 26.0	−12 56.1
19	101 26.0	55.3
20	116 26.1	54.4
21	131 26.1	53.6
22	146 26.1	52.7
23	161 26.1	51.9
24	176 26.2	−12 51.0
code	−	+ 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.6	−40 29.7
5	Achernar	336 00.4	−57 28.6
30	Acrux	173 59.8	−62 50.3
19	Adhara	255 47.8	−28 54.5
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.7	+56 12.5
34	Alkaid	153 34.1	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.1	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.3	+26 51.9
1	Alpheratz	358 30.7	+28 50.0
51	Altair	62 52.7	+ 8 44.4
2	Ankaa	354 00.4	−42 33.7
42	Antares	113 21.9	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.7	−68 56.6
22	Avior	234 36.1	−59 21.6
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 15.9	−52 40.3
12	Capella	281 41.2	+45 57.4
53	Deneb	50 02.9	+45 06.6
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.2	+62 00.0
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.5	+51 29.2
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.4
31	Gacrux	172 51.2	−56 51.0
29	Gienah	176 38.7	−17 17.0
35	Hadar	149 52.2	−60 08.8
6	Hamal	328 52.1	+23 14.7
48	Kaus Aust.	84 44.1	−34 24.6
40	Kochab	137 17.3	+74 20.4
57	Markab	14 23.8	+14 57.2
8	Menkar	315 02.4	+ 3 54.5
36	Menkent	149 01.0	−36 08.5
24	Miapl'dus	221 48.8	−69 31.5
9	Mirfak	309 45.3	+49 42.1
50	Nunki	76 54.6	−26 21.5
52	Peacock	54 30.9	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.6	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.7	−60 38.6
44	Sabik	103 04.6	−15 40.3
3	Schedar	350 32.8	+56 17.1
45	Shaula	97 23.6	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.4	−43 14.6
49	Vega	81 09.9	+38 44.0
39	Zub'g'bi	137 55.5	−15 51.0

GMT	Equation of Time (App.—Mean) 12	13	14
h	m s	m s	m s
0	−14 19.6	−14 19.0	−14 17.5
6	−14 19.5	−14 18.7	−14 17.1
12	−14 19.4	−14 18.3	−14 16.6
18	−14 19.2	−14 18.0	−14 16.0
24	−14 19.0	−14 17.5	−14 15.4

Lat.	Sunrise	Twlt. begins	Moonrise 12	13	14	15
N °	h m	h m	h m	h m	h m	h m
72	9 07	5 09	■	9 51	8 44	8 04
70	8 45	5 13	■	9 11	8 28	7 59
68	8 27	5 18	9 43	8 43	8 16	7 55
66	8 14	5 20	8 50	8 22	8 05	7 52
64	8 02	5 22	8 16	8 05	7 56	7 49
62	7 53	5 23	7 52	7 51	7 49	7 46
60	7 44	5 25	7 32	7 39	7 42	7 44
58	7 37	5 25	7 16	7 28	7 36	7 42
56	7 30	5 27	7 02	7 19	7 31	7 41
54	7 25	5 27	6 50	7 11	7 26	7 39
52	7 19	5 27	6 39	7 03	7 22	7 38
50	7 15	5 27	6 30	6 57	7 18	7 36
45	7 04	5 27	6 09	6 42	7 10	7 33
40	6 56	5 26	5 53	6 31	7 02	7 31
35	6 48	5 24	5 39	6 20	6 56	7 29
30	6 42	5 22	5 27	6 11	6 51	7 27
20	6 31	5 16	5 06	5 56	6 41	7 24
10	6 20	5 10	4 48	5 42	6 33	7 21
0	6 11	5 00	4 31	5 29	6 25	7 18
10	6 01	4 49	4 13	5 16	6 17	7 15
20	5 51	4 33	3 55	5 03	6 09	7 13
30	5 39	4 12	3 34	4 47	5 59	7 09
35	5 32	3 59	3 21	4 37	5 53	7 07
40	5 24	3 41	3 07	4 27	5 47	7 05
45	5 14	3 19	2 49	4 14	5 39	7 03
50	5 03	2 48	2 28	3 59	5 30	7 00
52	4 57	2 32	2 18	3 52	5 26	6 59
54	4 51	2 10	2 06	3 44	5 22	6 57
56	4 45	1 43	1 53	3 35	5 16	6 56
58	4 38	0 54	1 38	3 24	5 11	6 54
60	4 29	////	1 19	3 13	5 04	6 52
S						

Lat.	Sunset	Twlt. ends	Moonset 12	13	14	15
N °	h m	h m	h m	h m	h m	h m
72	15 24	19 25	■	14 03	17 06	19 40
70	15 46	19 21	■	14 40	17 19	19 40
68	16 03	19 16	12 04	15 06	17 29	19 40
66	16 16	19 13	12 57	15 26	17 37	19 41
64	16 28	19 11	13 29	15 41	17 44	19 41
62	16 37	19 08	13 53	15 54	17 50	19 41
60	16 45	19 07	14 11	16 05	17 55	19 41
58	16 53	19 06	14 27	16 14	17 59	19 41
56	16 59	19 05	14 40	16 23	18 03	19 41
54	17 05	19 05	14 51	16 30	18 07	19 41
52	17 10	19 04	15 01	16 36	18 10	19 42
50	17 15	19 04	15 10	16 42	18 13	19 42
45	17 25	19 04	15 29	16 55	18 19	19 42
40	17 33	19 04	15 44	17 05	18 24	19 42
35	17 41	19 06	15 57	17 14	18 29	19 42
30	17 47	19 08	16 08	17 21	18 33	19 42
20	17 58	19 12	16 27	17 34	18 39	19 42
10	18 08	19 19	16 44	17 45	18 45	19 42
0	18 18	19 29	16 59	17 56	18 50	19 42
10	18 27	19 39	17 14	18 06	18 56	19 43
20	18 38	19 55	17 30	18 17	19 01	19 43
30	18 49	20 14	17 48	18 30	19 07	19 43
35	18 56	20 28	17 59	18 37	19 11	19 43
40	19 04	20 45	18 11	18 45	19 15	19 43
45	19 14	21 07	18 25	18 54	19 20	19 42
50	19 25	21 37	18 42	19 05	19 25	19 42
52	19 30	21 53	18 50	19 11	19 28	19 42
54	19 36	22 13	18 58	19 16	19 30	19 42
56	19 42	22 39	19 08	19 22	19 33	19 42
58	19 50	23 22	19 20	19 29	19 36	19 42
60	19 58	////	19 32	19 37	19 40	19 42
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
12	10 45	15 04	14 44	17 15	4 17
13	11 43	15 03	14 43	17 12	4 13
14	12 38	15 02	14 42	17 08	4 09
15	13 30	15 01	14 40	17 05	4 05

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.2	0.1
30	0.5	0.2	0.1
45	0.5	0.1	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	12	13	14
°	′	′	′
0	20.4	21.0	21.1
4	20.4	21.0	21.1
8	20.3	21.0	21.1
12	20.3	20.9	21.0
16	20.2	20.8	20.9
20	20.1	20.7	20.8
24	20.0	20.6	20.7
28	19.9	20.4	20.6
32	19.7	20.3	20.4
36	19.6	20.1	20.2
40	19.4	19.9	20.0
44	19.2	19.7	19.8
48	19.0	19.5	19.6
52	18.8	19.2	19.3
56	18.6	19.0	19.1
60	18.4	18.7	18.8
64	18.1	18.5	18.5
68	17.9	18.2	18.3
72	17.6	17.9	18.0
76	17.4	17.6	17.7
80	17.1	17.3	17.4
84	16.9	17.0	17.1
88	16.7	16.8	16.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	12	13	14
°	′	′	′
0	12.8	12.4	12.4
4	12.8	12.5	12.4
8	12.8	12.5	12.4
12	12.9	12.5	12.5
16	13.0	12.6	12.6
20	13.1	12.7	12.7
24	13.2	12.9	12.8
28	13.3	13.0	12.9
32	13.4	13.2	13.2
36	13.6	13.3	13.3
40	13.8	13.5	13.5
44	13.9	13.7	13.7
48	14.1	14.0	13.9
52	14.3	14.2	14.2
56	14.6	14.4	14.4
60	14.8	14.7	14.7
64	15.0	15.0	15.0
68	15.3	15.2	15.2
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.1	16.1	16.1
84	16.3	16.4	16.4
88	16.5	16.6	16.7
90			

Subtract from table, back cover

Lincoln's Birthday 12
New Moon 14

918768°—52——3

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.4 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
15 0	144 42.2	134 30.7	+ 6 54.9	139 42.9	+ 1 43.3	103 12.2	+15 05.1	298 29.5	− 8 01.9	164 30.8	93	− 5 45.4	+171
1	159 44.6	149 31.3	56.0	154 43.7	44.1	118 14.4	05.2	313 32.0	01.8	178 59.1	93	5 28.3	+172
2	174 47.1	164 31.8	57.2	169 44.4	44.9	133 16.5	05.3	328 34.5	01.8	193 27.4	93	5 11.1	+172
3	189 49.6	179 32.4	·· 58.3	184 45.2	·· 45.6	148 18.7	·· 05.4	343 37.0	·· 01.8	207 55.7	94	• 4 53.9	+172
4	204 52.0	194 32.9	6 59.5	199 45.9	46.4	163 20.9	05.5	358 39.5	01.8	222 24.1	94	4 36.7	+173
5	219 54.5	209 33.5	7 00.6	214 46.7	47.2	178 23.0	05.6	13 42.0	01.7	236 52.5	95	4 19.4	+172
6	234 56.9	224 34.0	+ 7 01.8	229 47.4	+ 1 48.0	193 25.2	+15 05.7	28 44.5	− 8 01.7	251 21.0	95	− 4 02.2	+173
7	249 59.4	239 34.6	02.9	244 48.1	48.8	208 27.3	05.8	43 47.0	01.7	265 49.5	95	3 44.9	+173
8	265 01.9	254 35.1	04.1	259 48.9	49.5	223 29.5	05.9	58 49.5	01.7	280 18.0	96	3 27.6	+173
9	280 04.3	269 35.7	·· 05.2	274 49.6	·· 50.3	238 31.6	·· 06.0	73 52.1	·· 01.6	294 46.6	96	• 3 10.3	+173
10	295 06.8	284 36.2	06.4	289 50.4	51.1	253 33.8	06.1	88 54.6	01.6	309 15.2	96	2 53.0	+173
11	310 09.3	299 36.8	07.6	304 51.1	51.9	268 35.9	06.2	103 57.1	01.6	323 43.8	97	2 35.7	+173
12	325 11.7	314 37.3	+ 7 08.7	319 51.9	+ 1 52.6	283 38.1	+15 06.3	118 59.6	− 8 01.5	338 12.5	97	− 2 18.4	+173
13	340 14.2	329 37.9	09.9	334 52.6	53.4	298 40.2	06.4	134 02.1	01.5	352 41.2	98	2 01.1	+174
14	355 16.7	344 38.5	11.0	349 53.4	54.2	313 42.4	06.5	149 04.6	01.5	7 10.0	97	1 43.7	+173
15	10 19.1	359 39.0	·· 12.2	4 54.1	·· 55.0	328 44.5	·· 06.6	164 07.1	·· 01.5	21 38.7	98	• 1 26.4	+173
16	25 21.6	14 39.6	13.3	19 54.8	55.8	343 46.7	06.7	179 09.6	01.4	36 07.5	99	1 09.1	+173
17	40 24.1	29 40.1	14.5	34 55.6	56.5	358 48.8	06.8	194 12.1	01.4	50 36.4	98	0 51.8	+174
18	55 26.5	44 40.7	+ 7 15.6	49 56.3	+ 1 57.3	13 51.0	+15 06.9	209 14.6	− 8 01.4	65 05.2	99	− 0 34.4	+173
19	70 29.0	59 41.3	16.8	64 57.1	58.1	28 53.1	07.0	224 17.1	01.4	79 34.1	99	− 0 17.1	+173
20	85 31.4	74 41.8	17.9	79 57.8	58.9	43 55.3	07.1	239 19.6	01.3	94 03.0	99	+ 0 00.2	+173
21	100 33.9	89 42.4	·· 19.1	94 58.6	• 1 59.6	58 57.5	·· 07.3	254 22.1	·· 01.3	108 31.9	100	• 0 17.5	+172
22	115 36.4	104 43.0	20.2	109 59.3	2 00.4	73 59.6	07.4	269 24.6	01.3	123 00.9	99	0 34.7	+173
23	130 38.8	119 43.5	21.4	125 00.1	01.2	89 01.8	07.5	284 27.1	01.3	137 29.8	100	0 52.0	+172
16 0	145 41.3	134 44.1	+ 7 22.5	140 00.8	+ 2 02.0	104 03.9	+15 07.6	299 29.6	− 8 01.2	151 58.8	100	+ 1 09.2	+172
1	160 43.8	149 44.7	23.7	155 01.6	02.7	119 06.0	07.7	314 32.1	01.2	166 27.8	100	1 26.4	+172
2	175 46.2	164 45.2	24.8	170 02.3	03.5	134 08.2	07.8	329 34.6	01.2	180 56.8	101	1 43.6	+172
3	190 48.7	179 45.8	·· 25.9	185 03.0	·· 04.3	149 10.3	·· 07.9	344 37.1	·· 01.1	195 25.9	100	• 2 00.8	+172
4	205 51.2	194 46.4	27.1	200 03.8	05.1	164 12.5	08.0	359 39.6	01.1	209 54.9	101	2 18.0	+171
5	220 53.6	209 47.0	28.2	215 04.5	05.9	179 14.6	08.1	14 42.1	01.1	224 24.0	100	2 35.1	+171
6	235 56.1	224 47.5	+ 7 29.4	230 05.3	+ 2 06.6	194 16.8	+15 08.2	29 44.6	− 8 01.1	238 53.0	101	+ 2 52.2	+171
7	250 58.6	239 48.1	30.5	245 06.0	07.4	209 18.9	08.3	44 47.1	01.0	253 22.1	101	3 09.3	+170
8	266 01.0	254 48.7	31.7	260 06.8	08.2	224 21.1	08.4	59 49.7	01.0	267 51.2	101	3 26.3	+170
9	281 03.5	269 49.3	·· 32.8	275 07.5	·· 09.0	239 23.2	·· 08.5	74 52.2	·· 01.0	282 20.3	102	• 3 43.3	+169
10	296 05.9	284 49.9	34.0	290 08.3	09.7	254 25.4	08.6	89 54.7	01.0	296 49.5	101	4 00.2	+170
11	311 08.4	299 50.4	35.1	305 09.0	10.5	269 27.5	08.7	104 57.2	00.9	311 18.6	101	4 17.2	+168
12	326 10.9	314 51.0	+ 7 36.2	320 09.8	+ 2 11.3	284 29.7	+15 08.8	119 59.7	− 8 00.9	325 47.7	101	+ 4 34.0	+169
13	341 13.3	329 51.6	37.4	335 10.5	12.1	299 31.8	08.9	135 02.2	00.9	340 16.8	102	4 50.9	+168
14	356 15.8	344 52.2	38.5	350 11.2	12.8	314 34.0	09.0	150 04.7	00.8	354 46.0	101	5 07.7	+167
15	11 18.3	359 52.8	·· 39.7	5 12.0	·· 13.6	329 36.1	·· 09.2	165 07.2	·· 00.8	9 15.1	102	• 5 24.4	+167
16	26 20.7	14 53.4	40.8	20 12.7	14.4	344 38.3	09.3	180 09.7	00.8	23 44.3	101	5 41.1	+167
17	41 23.2	29 54.0	41.9	35 13.5	15.2	359 40.4	09.4	195 12.2	00.8	38 13.4	101	5 57.8	+166
18	56 25.7	44 54.5	+ 7 43.1	50 14.2	+ 2 15.9	14 42.6	+15 09.5	210 14.7	− 8 00.7	52 42.5	102	+ 6 14.4	+166
19	71 28.1	59 55.1	44.2	65 15.0	16.7	29 44.7	09.6	225 17.2	00.7	67 11.7	101	6 31.0	+165
20	86 30.6	74 55.7	45.4	80 15.7	17.5	44 46.8	09.7	240 19.7	00.7	81 40.8	101	6 47.5	+164
21	101 33.0	89 56.3	·· 46.5	95 16.5	·· 18.3	59 49.0	·· 09.8	255 22.3	·· 00.6	96 09.9	102	• 7 03.9	+164
22	116 35.5	104 56.9	47.6	110 17.2	19.1	74 51.1	09.9	270 24.8	00.6	110 39.1	101	7 20.3	+163
23	131 38.0	119 57.5	48.8	125 18.0	19.8	89 53.3	10.0	285 27.3	00.6	125 08.2	101	7 36.6	+163
17 0	146 40.4	134 58.1	+ 7 49.9	140 18.7	+ 2 20.6	104 55.4	+15 10.1	300 29.8	− 8 00.6	139 37.3	101	+ 7 52.9	+162
1	161 42.9	149 58.7	51.0	155 19.5	21.4	119 57.6	10.2	315 32.3	00.5	154 06.4	101	8 09.1	+162
2	176 45.4	164 59.3	52.2	170 20.2	22.2	134 59.7	10.3	330 34.8	00.5	168 35.5	101	8 25.3	+161
3	191 47.8	179 59.9	·· 53.3	185 20.9	·· 22.9	150 01.9	·· 10.4	345 37.3	·· 00.5	183 04.6	101	• 8 41.4	+160
4	206 50.3	195 00.5	54.4	200 21.7	23.7	165 04.0	10.5	0 39.8	00.4	197 33.7	101	8 57.4	+159
5	221 52.8	210 01.1	55.6	215 22.4	24.5	180 06.1	10.7	15 42.3	00.4	212 02.8	100	9 13.3	+159
6	236 55.2	225 01.7	+ 7 56.7	230 23.2	+ 2 25.3	195 08.3	+15 10.8	30 44.8	− 8 00.4	226 31.8	101	+ 9 29.2	+158
7	251 57.7	240 02.3	57.8	245 23.9	26.0	210 10.4	10.9	45 47.3	00.4	241 00.9	100	9 45.0	+157
8	267 00.2	255 02.9	7 59.0	260 24.7	26.8	225 12.6	11.0	60 49.9	00.3	255 29.9	100	10 00.7	+157
9	282 02.6	270 03.5	• 8 00.1	275 25.4	·· 27.6	240 14.7	·· 11.1	75 52.4	·· 00.3	269 58.9	100	•10 16.4	+156
10	297 05.1	285 04.1	01.2	290 26.2	28.4	255 16.8	11.2	90 54.9	00.3	284 27.9	100	10 32.0	+155
11	312 07.5	300 04.8	02.4	305 26.9	29.1	270 19.0	11.3	105 57.4	00.2	298 56.9	100	10 47.5	+154
12	327 10.0	315 05.4	+ 8 03.5	320 27.7	+ 2 29.9	285 21.1	+15 11.4	120 59.9	− 8 00.2	313 25.9	99	+11 02.9	+154
13	342 12.5	330 06.0	04.6	335 28.4	30.7	300 23.3	11.5	136 02.4	00.2	327 54.8	100	11 18.3	+152
14	357 14.9	345 06.6	05.8	350 29.2	31.5	315 25.4	11.6	151 04.9	00.2	342 23.8	99	11 33.5	+152
15	12 17.4	0 07.2	·· 06.9	5 29.9	·· 32.2	330 27.5	·· 11.7	166 07.4	·· 00.1	356 52.7	99	•11 48.7	+151
16	27 19.9	15 07.8	08.0	20 30.6	33.0	345 29.7	11.8	181 09.9	00.1	11 21.6	98	12 03.8	+150
17	42 22.3	30 08.4	09.1	35 31.4	33.8	0 31.8	11.9	196 12.5	00.1	25 50.4	99	12 18.8	+150
18	57 24.8	45 09.0	+ 8 10.3	50 32.1	+ 2 34.5	15 34.0	+15 12.0	211 15.0	− 8 00.0	40 19.3	98	+12 33.8	+148
19	72 27.3	60 09.7	11.4	65 32.9	35.3	30 36.1	12.2	226 17.5	00.0	54 48.1	98	12 48.6	+147
20	87 29.7	75 10.3	12.5	80 33.6	36.1	45 38.2	12.3	241 20.0	00.0	69 16.9	98	13 03.3	+147
21	102 32.2	90 10.9	·· 13.6	95 34.4	·· 36.9	60 40.4	·· 12.4	256 22.5	• 8 00.0	83 45.7	97	•13 18.0	+146
22	117 34.6	105 11.5	14.8	110 35.1	37.6	75 42.5	12.5	271 25.0	7 59.9	98 14.4	98	13 32.6	+144
23	132 37.1	120 12.2	15.9	125 35.9	38.4	90 44.7	12.6	286 27.5	59.9	112 43.2	97	13 47.0	+144
24	147 39.6	135 12.8	+ 8 17.0	140 36.6	+ 2 39.2	105 46.8	+15 12.7	301 30.1	− 7 59.9	127 11.9	96	+14 01.4	+143
code	—	+ 6	+ 12	+ 7	+ 8	+ 21	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.	STARS No.	Name	SHA	Dec.
h	° ′	° ′			° ′	° ′
15 0	176 26.2	−12 51.0	7	Acamar	315 52.6	−40 29.6
1	191 26.2	50.2	5	Achernar	336 00.4	−57 28.6
2	206 26.2	49.3	30	Acrux	173 59.7	−62 50.4
3	221 26.2	•• 48.5	19	Adhara	255 47.8	−28 54.5
4	236 26.3	47.6	10	Aldebaran	291 41.3	+16 25.1
5	251 26.3	46.7				
6	266 26.3	−12 45.9	32	Alioth	166 59.7	+56 12.5
7	281 26.4	45.0	34	Alkaid	153 34.1	+49 32.4
8	296 26.4	44.2	55	Al Na'ir	28 40.8	−47 11.4
9	311 26.4	•• 43.3	15	Alnilam	276 32.1	− 1 13.8
10	326 26.4	42.5	25	Alphard	218 40.2	− 8 27.4
11	341 26.5	41.6				
12	356 26.5	−12 40.7	41	Alphecca	126 49.3	+26 51.9
13	11 26.5	39.9	1	Alpheratz	358 30.8	+28 50.0
14	26 26.6	39.0	51	Altair	62 52.7	+ 8 44.4
15	41 26.6	•• 38.2	2	Ankaa	354 00.5	−42 33.7
16	56 26.6	37.3	42	Antares	113 21.9	−26 19.9
17	71 26.7	36.4				
18	86 26.7	−12 35.6	37	Arcturus	146 36.8	+19 25.2
19	101 26.7	34.7	43	Atria	109 04.6	−68 56.6
20	116 26.8	33.8	22	Avior	234 36.1	−59 21.6
21	131 26.8	•• 33.0	13	Bellatrix	279 20.4	+ 6 18.6
22	146 26.8	32.1	16	Betelg'se	271 50.1	+ 7 24.0
23	161 26.9	31.3				
			17	Canopus	264 15.9	−52 40.3
16 0	176 26.9	−12 30.4	12	Capella	281 41.2	+45 57.4
1	191 26.9	29.5	53	Deneb	50 02.9	+45 06.6
2	206 27.0	28.7	28	Denebola	183 19.4	+14 49.8
3	221 27.0	•• 27.8	4	Diphda	349 41.4	−18 14.7
4	236 27.0	26.9				
5	251 27.1	26.1	27	Dubhe	194 46.1	+62 00.1
6	266 27.1	−12 25.2	14	Elnath	279 09.7	+28 34.3
7	281 27.1	24.3	47	Eltanin	91 07.4	+51 29.2
8	296 27.2	23.5	54	Enif	34 31.9	+ 9 39.5
9	311 27.2	•• 22.6	56	Fomalhaut	16 14.1	−29 52.4
10	326 27.2	21.7				
11	341 27.3	20.9	31	Gacrux	172 51.2	−56 51.0
12	356 27.3	−12 20.0	29	Gienah	176 38.7	−17 17.1
13	11 27.4	19.1	35	Hadar	149 52.1	−60 08.8
14	26 27.4	18.3	6	Hamal	328 52.1	+23 14.6
15	41 27.4	•• 17.4	48	Kaus Aust.	84 44.1	−34 24.6
16	56 27.5	16.5				
17	71 27.5	15.7	40	Kochab	137 17.2	+74 20.4
18	86 27.6	−12 14.8	57	Markab	14 23.8	+14 57.1
19	101 27.6	13.9	8	Menkar	315 02.5	+ 3 54.5
20	116 27.6	13.1	36	Menkent	149 00.9	−36 08.5
21	131 27.7	•• 12.2	24	Miapl'dus	221 48.8	−69 31.5
22	146 27.7	11.3				
23	161 27.8	10.5	9	Mirfak	309 45.4	+49 42.1
			50	Nunki	76 54.6	−26 21.5
17 0	176 27.8	−12 09.6	52	Peacock	54 30.9	−56 53.2
1	191 27.8	08.7	21	Pollux	244 22.7	+28 08.5
2	206 27.9	07.8	20	Procyon	245 46.8	+ 5 20.7
3	221 27.9	•• 07.0				
4	236 28.0	06.1	46	R'alhague	96 48.6	+12 35.3
5	251 28.0	05.2	26	Regulus	208 31.3	+12 11.7
6	266 28.1	−12 04.3	11	Rigel	281 55.4	− 8 15.3
7	281 28.1	03.5	38	Rigil Kent.	140 53.7	−60 38.6
8	296 28.1	02.6	44	Sabik	103 04.6	−15 40.3
9	311 28.2	•• 01.7				
10	326 28.2	00.8	3	Schedar	350 32.8	+56 17.1
11	341 28.3	12 00.0	45	Shaula	97 23.6	−37 04.3
12	356 28.3	−11 59.1	18	Sirius	259 13.4	−16 39.1
13	11 28.4	58.2	33	Spica	159 18.8	−10 55.2
14	26 28.4	57.3	23	Suhail	223 25.4	−43 14.7
15	41 28.5	•• 56.5				
16	56 28.5	55.6	49	Vega	81 09.9	+38 44.0
17	71 28.6	54.7	39	Zub'g'bi	137 55.5	−15 51.1
18	86 28.6	−11 53.8				
19	101 28.6	53.0				
20	116 28.7	52.1				
21	131 28.7	•• 51.2				
22	146 28.8	50.3				
23	161 28.8	49.4				
24	176 28.9	−11 48.6				
code	−	+ 9				

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 15 h m	16 h m	17 h m	18 h m
72	8 49	4 56	8 04	7 29	6 51	5 55
70	8 30	5 03	7 59	7 33	7 05	6 28
68	8 15	5 07	7 55	7 36	7 17	6 53
66	8 03	5 11	7 52	7 39	7 27	7 12
64	7 52	5 14	7 49	7 42	7 35	7 27
62	7 44	5 16	7 46	7 44	7 42	7 40
60	7 36	5 18	7 44	7 46	7 48	7 51
58	7 30	5 19	7 42	7 48	7 54	8 01
56	7 24	5 20	7 41	7 49	7 59	8 10
54	7 18	5 22	7 39	7 51	8 03	8 17
52	7 14	5 22	7 38	7 52	8 07	8 24
50	7 09	5 22	7 36	7 53	8 11	8 30
45	7 00	5 22	7 33	7 56	8 19	8 44
40	6 52	5 22	7 31	7 58	8 25	8 55
35	6 45	5 21	7 29	8 00	8 31	9 04
30	6 39	5 20	7 27	8 02	8 36	9 13
20	6 29	5 15	7 24	8 04	8 45	9 28
10	6 20	5 09	7 21	8 07	8 53	9 40
0	6 11	5 01	7 18	8 10	9 01	9 53
10	6 02	4 50	7 15	8 12	9 08	10 05
20	5 52	4 35	7 13	8 15	9 17	10 18
30	5 41	4 15	7 09	8 18	9 26	10 33
35	5 35	4 03	7 07	8 20	9 32	10 42
40	5 27	3 46	7 05	8 22	9 38	10 53
45	5 19	3 25	7 03	8 25	9 45	11 05
50	5 08	2 56	7 00	8 28	9 54	11 19
52	5 03	2 41	6 59	8 29	9 58	11 26
54	4 58	2 22	6 57	8 31	10 03	11 34
56	4 52	1 58	6 56	8 32	10 08	11 43
58	4 45	1 23	6 54	8 34	10 14	11 53
60 S	4 37	////	6 52	8 36	10 20	12 04

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 15 h m	16 h m	17 h m	18 h m
72	15 41	19 37	19 40	22 09	24 55	0 55
70	16 00	19 32	19 40	21 58	24 24	0 24
68	16 15	19 26	19 40	21 49	24 02	0 02
66	16 27	19 22	19 41	21 41	23 45	25 56
64	16 37	19 19	19 41	21 35	23 31	25 30
62	16 46	19 16	19 41	21 30	23 19	25 09
60	16 53	19 14	19 41	21 25	23 09	24 53
58	17 00	19 12	19 41	21 21	23 00	24 39
56	17 06	19 11	19 41	21 18	22 53	24 27
54	17 11	19 10	19 41	21 14	22 46	24 17
52	17 16	19 10	19 42	21 11	22 40	24 07
50	17 20	19 09	19 42	21 09	22 35	23 59
45	17 29	19 08	19 42	21 03	22 23	23 42
40	17 37	19 08	19 42	20 58	22 14	23 28
35	17 43	19 08	19 42	20 54	22 05	23 16
30	17 49	19 09	19 42	20 51	21 58	23 05
20	18 00	19 14	19 42	20 44	21 46	22 47
10	18 09	19 20	19 42	20 39	21 35	22 32
0	18 18	19 28	19 42	20 34	21 25	22 18
10	18 26	19 38	19 43	20 29	21 15	22 03
20	18 36	19 52	19 43	20 23	21 05	21 48
30	18 47	20 12	19 43	20 17	20 53	21 31
35	18 53	20 24	19 43	20 14	20 46	21 21
40	19 00	20 39	19 43	20 10	20 38	21 09
45	19 09	21 00	19 42	20 05	20 29	20 56
50	19 19	21 28	19 42	20 00	20 18	20 39
52	19 24	21 42	19 42	19 57	20 13	20 32
54	19 29	22 00	19 42	19 54	20 07	20 23
56	19 35	22 22	19 42	19 51	20 01	20 14
58	19 42	22 55	19 42	19 48	19 54	20 03
60 S	19 49	////	19 42	19 44	19 47	19 51

GMT h	Equation of Time (App.—Mean) 15 m s	16 m s	17 m s
0	−14 15.4	−14 12.5	−14 08.9
6	−14 14.7	−14 11.7	−14 07.9
12	−14 14.0	−14 10.8	−14 06.8
18	−14 13.3	−14 09.9	−14 05.7
24	−14 12.5	−14 08.9	−14 04.6

GMT of Transit Meridian of Greenwich DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
15	13 30	15 01	14 40	17 05	4 05
16	14 22	15 01	14 39	17 01	4 01
17	15 13	15 00	14 38	16 58	3 57
18	16 05	14 59	14 37	16 55	3 53

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.2	0.1
30	0.5	0.2	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	15 ′	16 ′	17 ′
0	20.9	20.3	19.4
4	20.9	20.2	19.4
8	20.8	20.2	19.3
12	20.8	20.1	19.3
16	20.7	20.1	19.2
20	20.6	20.0	19.2
24	20.5	19.9	19.1
28	20.3	19.8	19.0
32	20.2	19.6	18.9
36	20.0	19.5	18.7
40	19.8	19.3	18.6
44	19.6	19.1	18.5
48	19.4	18.9	18.3
52	19.2	18.7	18.1
56	18.9	18.5	18.0
60	18.7	18.3	17.8
64	18.4	18.1	17.6
68	18.1	17.8	17.4
72	17.9	17.6	17.2
76	17.6	17.3	17.0
80	17.3	17.1	16.8
84	17.0	16.8	16.6
88	16.8	16.6	16.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	15 ′	16 ′	17 ′
0	12.5	12.9	13.4
4	12.5	12.9	13.4
8	12.6	12.9	13.4
12	12.6	13.0	13.5
16	12.7	13.0	13.5
20	12.8	13.1	13.6
24	12.9	13.2	13.7
28	13.1	13.4	13.8
32	13.2	13.5	13.9
36	13.4	13.6	14.0
40	13.6	13.8	14.1
44	13.8	14.0	14.3
48	14.0	14.2	14.4
52	14.2	14.4	14.6
56	14.5	14.6	14.8
60	14.7	14.8	15.0
64	15.0	15.1	15.1
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.7
80	16.1	16.0	15.9
84	16.4	16.3	16.2
88	16.6	16.5	16.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.5 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
18 0	147 39.6	135 12.8	+ 8 17.0	140 36.6	+ 2 39.2	105 46.8	+15 12.7	301 30.1	− 7 59.9	127 11.9	96	+14 01.4	+143
1	162 42.0	150 13.4	18.1	155 37.4	40.0	120 48.9	12.8	316 32.6	59.8	141 40.5	97	14 15.7	+142
2	177 44.5	165 14.0	19.3	170 38.1	40.7	135 51.1	12.9	331 35.1	59.8	156 09.2	96	14 29.9	+140
3	192 47.0	180 14.7	·· 20.4	185 38.9	·· 41.5	150 53.2	·· 13.0	346 37.6	·· 59.8	170 37.8	96	·14 43.9	+140
4	207 49.4	195 15.3	21.5	200 39.6	42.3	165 55.3	13.1	1 40.1	59.7	185 06.4	96	14 57.9	+139
5	222 51.9	210 15.9	22.6	215 40.3	43.1	180 57.5	13.2	16 42.6	59.7	199 35.0	95	15 11.8	+138
6	237 54.4	225 16.5	+ 8 23.8	230 41.1	+ 2 43.8	195 59.6	+15 13.4	31 45.1	− 7 59.7	214 03.5	95	+15 25.6	+137
7	252 56.8	240 17.2	24.9	245 41.8	44.6	211 01.7	13.5	46 47.6	59.7	228 32.0	95	15 39.3	+135
8	267 59.3	255 17.8	26.0	260 42.6	45.4	226 03.9	13.6	61 50.2	59.6	243 00.5	94	15 52.8	+135
9	283 01.8	270 18.4	·· 27.1	275 43.3	·· 46.2	241 06.0	·· 13.7	76 52.7	·· 59.6	257 28.9	94	·16 06.3	+133
10	298 04.2	285 19.1	28.2	290 44.1	46.9	256 08.2	13.8	91 55.2	59.6	271 57.3	94	16 19.6	+133
11	313 06.7	300 19.7	29.4	305 44.8	47.7	271 10.3	13.9	106 57.7	59.5	286 25.7	94	16 32.9	+131
12	328 09.1	315 20.4	+ 8 30.5	320 45.6	+ 2 48.5	286 12.4	+15 14.0	122 00.2	− 7 59.5	300 54.1	93	+16 46.0	+130
13	343 11.6	330 21.0	31.6	335 46.3	49.2	301 14.6	14.1	137 02.7	59.5	315 22.4	93	16 59.0	+129
14	358 14.1	345 21.6	32.7	350 47.1	50.0	316 16.7	14.2	152 05.3	59.4	329 50.7	92	17 11.9	+128
15	13 16.5	0 22.3	·· 33.8	5 47.8	·· 50.8	331 18.8	·· 14.3	167 07.8	·· 59.4	344 18.9	92	·17 24.7	+127
16	28 19.0	15 22.9	34.9	20 48.6	51.6	346 21.0	14.4	182 10.3	59.4	358 47.1	92	17 37.4	+126
17	43 21.5	30 23.6	36.1	35 49.3	52.3	1 23.1	14.6	197 12.8	59.3	13 15.3	92	17 50.0	+124
18	58 23.9	45 24.2	+ 8 37.2	50 50.1	+ 2 53.1	16 25.2	+15 14.7	212 15.3	− 7 59.3	27 43.5	91	+18 02.4	+124
19	73 26.4	60 24.9	38.3	65 50.8	53.9	31 27.4	14.8	227 17.8	59.3	42 11.6	90	18 14.8	+122
20	88 28.9	75 25.5	39.4	80 51.5	54.6	46 29.5	14.9	242 20.3	59.3	56 39.6	91	18 27.0	+121
21	103 31.3	90 26.2	·· 40.5	95 52.3	·· 55.4	61 31.6	·· 15.0	257 22.9	·· 59.2	71 07.7	90	·18 39.1	+119
22	118 33.8	105 26.8	41.6	110 53.0	56.2	76 33.7	15.1	272 25.4	59.2	85 35.7	90	18 51.0	+119
23	133 36.3	120 27.5	42.7	125 53.8	57.0	91 35.9	15.2	287 27.9	59.2	100 03.7	89	19 02.9	+117
19 0	148 38.7	135 28.1	+ 8 43.8	140 54.5	+ 2 57.7	106 38.0	+15 15.3	302 30.4	− 7 59.1	114 31.6	89	+19 14.6	+116
1	163 41.2	150 28.8	45.0	155 55.3	58.5	121 40.1	15.4	317 32.9	59.1	128 59.5	89	19 26.2	+115
2	178 43.6	165 29.4	46.1	170 56.0	2 59.3	136 42.3	15.5	332 35.5	59.1	143 27.4	88	19 37.7	+113
3	193 46.1	180 30.1	·· 47.2	185 56.8	· 3 00.1	151 44.4	·· 15.7	347 38.0	·· 59.0	157 55.2	89	·19 49.0	+113
4	208 48.6	195 30.7	48.3	200 57.5	00.8	166 46.5	15.8	2 40.5	59.0	172 23.1	87	20 00.3	+111
5	223 51.0	210 31.4	49.4	215 58.3	01.6	181 48.7	15.9	17 43.0	59.0	186 50.8	88	20 11.4	+109
6	238 53.5	225 32.1	+ 8 50.5	230 59.0	+ 3 02.4	196 50.8	+15 16.0	32 45.5	− 7 58.9	201 18.6	87	+20 22.3	+109
7	253 56.0	240 32.7	51.6	245 59.8	03.1	211 52.9	16.1	47 48.0	58.9	215 46.3	86	20 33.2	+107
8	268 58.4	255 33.4	52.7	261 00.5	03.9	226 55.1	16.2	62 50.6	58.9	230 13.9	87	20 43.9	+105
9	284 00.9	270 34.1	·· 53.8	276 01.3	·· 04.7	241 57.2	·· 16.3	77 53.1	·· 58.8	244 41.6	86	·20 54.4	+105
10	299 03.4	285 34.7	54.9	291 02.0	05.5	256 59.3	16.4	92 55.6	58.8	259 09.2	85	21 04.9	+103
11	314 05.8	300 35.4	56.0	306 02.8	06.2	272 01.4	16.5	107 58.1	58.8	273 36.7	85	21 15.2	+102
12	329 08.3	315 36.1	+ 8 57.1	321 03.5	+ 3 07.0	287 03.6	+15 16.6	123 00.6	− 7 58.8	288 04.2	85	+21 25.4	+100
13	344 10.7	330 36.7	58.3	336 04.2	07.8	302 05.7	16.8	138 03.2	58.7	302 31.7	85	21 35.4	+ 99
14	359 13.2	345 37.4	8 59.4	351 05.0	08.5	317 07.8	16.9	153 05.7	58.7	316 59.2	84	21 45.3	+ 98
15	14 15.7	0 38.1	· 9 00.5	6 05.7	·· 09.3	332 10.0	·· 17.0	168 08.2	·· 58.7	331 26.6	84	·21 55.1	+ 96
16	29 18.1	15 38.7	01.6	21 06.5	10.1	347 12.1	17.1	183 10.7	58.6	345 54.0	84	22 04.7	+ 95
17	44 20.6	30 39.4	02.7	36 07.2	10.8	2 14.2	17.2	198 13.2	58.6	0 21.4	83	22 14.2	+ 94
18	59 23.1	45 40.1	+ 9 03.8	51 08.0	+ 3 11.6	17 16.3	+15 17.3	213 15.8	− 7 58.6	14 48.7	83	+22 23.6	+ 92
19	74 25.5	60 40.8	04.9	66 08.7	12.4	32 18.5	17.4	228 18.3	58.5	29 16.0	83	22 32.8	+ 91
20	89 28.0	75 41.4	06.0	81 09.5	13.2	47 20.6	17.5	243 20.8	58.5	43 43.3	83	22 41.9	+ 89
21	104 30.5	90 42.1	·· 07.1	96 10.2	·· 13.9	62 22.7	·· 17.6	258 23.3	·· 58.5	58 10.6	82	·22 50.8	+ 88
22	119 32.9	105 42.8	08.2	111 11.0	14.7	77 24.8	17.8	273 25.8	58.4	72 37.8	82	22 59.6	+ 87
23	134 35.4	120 43.5	09.3	126 11.7	15.5	92 27.0	17.9	288 28.4	58.4	87 05.0	81	23 08.3	+ 85
20 0	149 37.9	135 44.2	+ 9 10.4	141 12.5	+ 3 16.2	107 29.1	+15 18.0	303 30.9	− 7 58.4	101 32.1	81	+23 16.8	+ 84
1	164 40.3	150 44.9	11.5	156 13.2	17.0	122 31.2	18.1	318 33.4	58.3	115 59.2	81	23 25.2	+ 82
2	179 42.8	165 45.5	12.6	171 14.0	17.8	137 33.3	18.2	333 35.9	58.3	130 26.3	81	23 33.4	+ 81
3	194 45.2	180 46.2	·· 13.7	186 14.7	·· 18.5	152 35.5	·· 18.3	348 38.4	·· 58.3	144 53.4	81	·23 41.5	+ 79
4	209 47.7	195 46.9	14.8	201 15.5	19.3	167 37.6	18.4	3 41.0	58.2	159 20.5	80	23 49.4	+ 78
5	224 50.2	210 47.6	15.9	216 16.2	20.1	182 39.7	18.5	18 43.5	58.2	173 47.5	80	23 57.2	+ 77
6	239 52.6	225 48.3	+ 9 16.9	231 17.0	+ 3 20.9	197 41.8	+15 18.6	33 46.0	− 7 58.2	188 14.5	80	+24 04.9	+ 75
7	254 55.1	240 49.0	18.0	246 17.7	21.6	212 44.0	18.8	48 48.5	58.1	202 41.5	79	24 12.4	+ 73
8	269 57.6	255 49.7	19.1	261 18.5	22.4	227 46.1	18.9	63 51.1	58.1	217 08.4	79	24 19.7	+ 72
9	285 00.0	270 50.4	·· 20.2	276 19.2	·· 23.2	242 48.2	·· 19.0	78 53.6	·· 58.1	231 35.3	79	·24 26.9	+ 71
10	300 02.5	285 51.1	21.3	291 19.9	23.9	257 50.3	19.1	93 56.1	58.0	246 02.2	79	24 34.0	+ 69
11	315 05.0	300 51.8	22.4	306 20.7	24.7	272 52.5	19.2	108 58.6	58.0	260 29.1	79	24 40.9	+ 68
12	330 07.4	315 52.5	+ 9 23.5	321 21.4	+ 3 25.5	287 54.6	+15 19.3	124 01.1	− 7 58.0	274 56.0	78	+24 47.7	+ 66
13	345 09.9	330 53.2	24.6	336 22.2	26.2	302 56.7	19.4	139 03.7	57.9	289 22.8	79	24 54.3	+ 65
14	0 12.4	345 53.9	25.7	351 22.9	27.0	317 58.8	19.5	154 06.2	57.9	303 49.7	78	25 00.8	+ 63
15	15 14.8	0 54.6	·· 26.8	6 23.7	·· 27.8	333 00.9	·· 19.7	169 08.7	·· 57.9	318 16.5	78	·25 07.1	+ 61
16	30 17.3	15 55.3	27.9	21 24.4	28.5	348 03.1	19.8	184 11.2	57.8	332 43.3	77	25 13.2	+ 61
17	45 19.7	30 56.0	29.0	36 25.2	29.3	3 05.2	19.9	199 13.8	57.8	347 10.0	78	25 19.3	+ 58
18	60 22.2	45 56.7	+ 9 30.0	51 25.9	+ 3 30.1	18 07.3	+15 20.0	214 16.3	− 7 57.8	1 36.8	78	+25 25.1	+ 57
19	75 24.7	60 57.4	31.1	66 26.7	30.8	33 09.4	20.1	229 18.8	57.7	16 03.6	77	25 30.8	+ 56
20	90 27.1	75 58.1	32.2	81 27.4	31.6	48 11.5	20.2	244 21.3	57.7	30 30.3	77	25 36.4	+ 54
21	105 29.6	90 58.8	·· 33.3	96 28.2	·· 32.4	63 13.7	·· 20.3	259 23.9	·· 57.7	44 57.0	77	·25 41.8	+ 53
22	120 32.1	105 59.5	34.4	111 28.9	33.2	78 15.8	20.4	274 26.4	57.6	59 23.7	78	25 47.1	+ 51
23	135 34.5	121 00.2	35.5	126 29.7	33.9	93 17.9	20.6	289 28.9	57.6	73 50.5	77	25 52.2	+ 49
24	150 37.0	136 01.0	+ 9 36.6	141 30.4	+ 3 34.7	108 20.0	+15 20.7	304 31.4	− 7 57.6	88 17.2	76	+25 57.1	+ 49
code	—	+ 6	+ 12	+ 7	+ 8	+ 21	+ 2	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
18 0	176 28.9	−11 48.6
1	191 28.9	47.7
2	206 29.0	46.8
3	221 29.0	45.9
4	236 29.1	45.0
5	251 29.1	44.2
6	266 29.2	−11 43.3
7	281 29.2	42.4
8	296 29.3	41.5
9	311 29.3	40.6
10	326 29.4	39.8
11	341 29.4	38.9
12	356 29.5	−11 38.0
13	11 29.6	37.1
14	26 29.6	36.2
15	41 29.7	35.3
16	56 29.7	34.5
17	71 29.8	33.6
18	86 29.8	−11 32.7
19	101 29.9	31.8
20	116 29.9	30.9
21	131 30.0	30.0
22	146 30.0	29.1
23	161 30.1	28.3
19 0	176 30.2	−11 27.4
1	191 30.2	26.5
2	206 30.3	25.6
3	221 30.3	24.7
4	236 30.4	23.8
5	251 30.4	22.9
6	266 30.5	−11 22.0
7	281 30.6	21.2
8	296 30.6	20.3
9	311 30.7	19.4
10	326 30.7	18.5
11	341 30.8	17.6
12	356 30.9	−11 16.7
13	11 30.9	15.8
14	26 31.0	14.9
15	41 31.0	14.0
16	56 31.1	13.1
17	71 31.2	12.3
18	86 31.2	−11 11.4
19	101 31.3	10.5
20	116 31.3	09.6
21	131 31.4	08.7
22	146 31.5	07.8
23	161 31.5	06.9
20 0	176 31.6	−11 06.0
1	191 31.7	05.1
2	206 31.7	04.2
3	221 31.8	03.3
4	236 31.9	02.4
5	251 31.9	01.5
6	266 32.0	−11 00.6
7	281 32.0	10 59.7
8	296 32.1	58.8
9	311 32.2	57.9
10	326 32.2	57.0
11	341 32.3	56.1
12	356 32.4	−10 55.2
13	11 32.4	54.4
14	26 32.5	53.5
15	41 32.6	52.6
16	56 32.6	51.7
17	71 32.7	50.8
18	86 32.8	−10 49.9
19	101 32.9	49.0
20	116 32.9	48.1
21	131 33.0	47.2
22	146 33.1	46.3
23	161 33.1	45.4
24	176 33.2	−10 44.5
code	−	+ 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.6	−40 29.6
5	Achernar	336 00.5	−57 28.6
30	Acrux	173 59.7	−62 50.4
19	Adhara	255 47.8	−28 54.6
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.7	+56 12.5
34	Alkaid	153 34.0	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.2	+26 51.9
1	Alpheratz	358 30.8	+28 50.0
51	Altair	62 52.6	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.9	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.6	−68 56.6
22	Avior	234 36.1	−59 21.6
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 15.9	−52 40.3
12	Capella	281 41.2	+45 57.4
53	Deneb	50 02.9	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.4	−18 14.7
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.4	+51 29.2
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.2	−56 51.1
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.1	−60 08.8
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 44.0	−34 24.6
40	Kochab	137 17.1	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.9	−36 08.5
24	Miapl'dus	221 48.8	−69 31.5
9	Mirfak	309 45.4	+49 42.1
50	Nunki	76 54.6	−26 21.5
52	Peacock	54 30.8	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.6	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.6	−60 38.6
44	Sabik	103 04.6	−15 40.3
3	Schedar	350 32.9	+56 17.1
45	Shaula	97 23.5	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.4	−43 14.7
49	Vega	81 09.9	+38 44.0
39	Zub'g'bi	137 55.5	−15 51.1

GMT	Equation of Time (App.—Mean) 18	19	20
h	m s	m s	m s
0	−14 04.6	−13 59.5	−13 53.8
6	−14 03.3	−13 58.1	−13 52.2
12	−14 02.1	−13 56.7	−13 50.6
18	−14 00.8	−13 55.3	−13 49.0
24	−13 59.5	−13 53.8	−13 47.3

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 18 h m	19 h m	20 h m	21 h m
72	8 32	4 43	5 55	▭	▭	▭
70	8 15	4 50	6 28	4 40	▭	▭
68	8 02	4 56	6 53	6 11	▭	▭
66	7 51	5 01	7 12	6 50	5 46	▭
64	7 42	5 05	7 27	7 18	7 04	▭
62	7 35	5 08	7 40	7 39	7 41	7 48
60	7 28	5 11	7 51	7 57	8 07	8 28
58	7 22	5 12	8 01	8 12	8 28	8 56
56	7 17	5 14	8 10	8 24	8 45	9 17
54	7 12	5 15	8 17	8 35	9 00	9 35
52	7 08	5 17	8 24	8 45	9 13	9 50
50	7 04	5 18	8 30	8 54	9 24	10 03
45	6 55	5 19	8 44	9 13	9 48	10 30
40	6 48	5 18	8 55	9 28	10 07	10 52
35	6 42	5 18	9 04	9 41	10 23	11 10
30	6 37	5 18	9 13	9 53	10 36	11 25
20	6 27	5 14	9 28	10 12	11 00	11 52
10	6 19	5 08	9 40	10 29	11 21	12 14
0	6 11	5 01	9 53	10 46	11 40	12 35
10	6 02	4 50	10 05	11 02	12 00	12 57
20	5 54	4 37	10 18	11 20	12 20	13 19
30	5 43	4 19	10 33	11 40	12 45	13 46
35	5 37	4 07	10 42	11 52	12 59	14 02
40	5 31	3 51	10 53	12 06	13 16	14 20
45	5 23	3 31	11 05	12 22	13 36	14 42
50	5 13	3 05	11 19	12 43	14 01	15 10
52	5 09	2 51	11 26	12 52	14 13	15 24
54	5 04	2 35	11 34	13 03	14 27	15 40
56	4 58	2 13	11 43	13 16	14 44	15 59
58	4 52	1 46	11 53	13 31	15 03	16 23
60	4 45	0 57	12 04	13 48	15 28	16 54
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 18 h m	19 h m	20 h m	21 h m
72	15 58	19 51	0 55	▭	▭	▭
70	16 14	19 43	0 24	4 05	▭	▭
68	16 27	19 37	0 02	2 35	▭	▭
66	16 38	19 32	25 56	1 56	4 54	▭
64	16 47	19 28	25 30	1 30	3 37	▭
62	16 55	19 24	25 09	1 09	3 01	4 48
60	17 01	19 21	24 53	0 53	2 35	4 09
58	17 07	19 19	24 39	0 39	2 15	3 42
56	17 12	19 17	24 27	0 27	1 58	3 20
54	17 17	19 16	24 17	0 17	1 44	3 03
52	17 21	19 14	24 07	0 07	1 31	2 48
50	17 25	19 13	23 59	25 20	1 20	2 35
45	17 33	19 11	23 42	24 58	0 58	2 08
40	17 40	19 11	23 28	24 40	0 40	1 47
35	17 46	19 11	23 16	24 24	0 24	1 30
30	17 52	19 12	23 05	24 11	0 11	1 15
20	18 01	19 15	22 47	23 49	24 49	0 49
10	18 09	19 20	22 32	23 29	24 27	0 27
0	18 17	19 27	22 18	23 11	24 07	0 07
10	18 25	19 37	22 03	22 54	23 46	24 40
20	18 34	19 50	21 48	22 34	23 24	24 17
30	18 44	20 08	21 31	22 12	22 59	23 50
35	18 50	20 20	21 21	22 00	22 44	23 34
40	18 56	20 34	21 09	21 45	22 27	23 16
45	19 04	20 53	20 56	21 27	22 06	22 53
50	19 14	21 20	20 39	21 06	21 40	22 25
52	19 18	21 33	20 32	20 56	21 28	22 11
54	19 23	21 49	20 23	20 44	21 13	21 55
56	19 28	22 08	20 14	20 31	20 57	21 36
58	19 34	22 35	20 03	20 16	20 37	21 12
60	19 41	23 18	19 51	19 58	20 12	20 41
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
18	16 05	14 59	14 37	16 55	3 53
19	16 59	14 58	14 36	16 51	3 49
20	17 53	14 56	14 34	16 48	3 45
21	18 49	14 55	14 33	16 44	3 41

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.3	0.1
30	0.5	0.2	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	18 ′	19 ′	20 ′
0	18.2	17.1	15.9
4	18.2	17.1	15.9
8	18.2	17.1	15.9
12	18.2	17.0	15.9
16	18.1	17.0	15.9
20	18.1	17.0	15.9
24	18.0	17.0	15.9
28	17.9	16.9	15.9
32	17.9	16.9	15.9
36	17.8	16.8	15.9
40	17.7	16.8	15.9
44	17.6	16.7	15.8
48	17.5	16.6	15.8
52	17.4	16.6	15.8
56	17.2	16.5	15.8
60	17.1	16.4	15.8
64	17.0	16.4	15.8
68	16.8	16.3	15.7
72	16.7	16.2	15.7
76	16.6	16.1	15.7
80	16.4	16.0	15.7
84	16.3	16.0	15.7
88	16.2	15.9	15.6
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	18 ′	19 ′	20 ′
0	14.0	14.7	15.3
4	14.0	14.7	15.3
8	14.1	14.7	15.3
12	14.1	14.7	15.3
16	14.1	14.7	15.3
20	14.2	14.8	15.4
24	14.2	14.8	15.4
28	14.3	14.8	15.4
32	14.4	14.9	15.4
36	14.5	14.9	15.4
40	14.6	15.0	15.4
44	14.7	15.0	15.4
48	14.8	15.1	15.4
52	14.9	15.2	15.5
56	15.0	15.2	15.5
60	15.1	15.3	15.5
64	15.3	15.4	15.5
68	15.4	15.5	15.5
72	15.5	15.5	15.5
76	15.7	15.6	15.6
80	15.8	15.7	15.6
84	16.0	15.8	15.6
88	16.1	15.9	15.6
90			

Subtract from table, back cover

Ash Wednesday 18
First Quarter 20

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.5 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
21 0	150 37.0	136 01.0	+ 9 36.6	141 30.4	+ 3 34.7	108 20.0	+15 20.7	304 31.4	− 7 57.6	88 17.2	76	+25 57.1	+ 49
1	165 39.5	151 01.7	37.7	156 31.2	35.5	123 22.1	20.8	319 34.0	57.5	102 43.8	77	26 02.0	+ 46
2	180 41.9	166 02.4	38.7	171 31.9	36.2	138 24.3	20.9	334 36.5	57.5	117 10.5	77	26 06.6	+ 45
3	195 44.4	181 03.1	39.8	186 32.7	37.0	153 26.4	21.0	349 39.0	57.5	131 37.2	77	+26 11.1	+ 44
4	210 46.9	196 03.8	40.9	201 33.4	37.8	168 28.5	21.1	4 41.5	57.4	146 03.9	77	26 15.5	+ 41
5	225 49.3	211 04.6	42.0	216 34.2	38.5	183 30.6	21.2	19 44.1	57.4	160 30.6	77	26 19.6	+ 41
6	240 51.8	226 05.3	+ 9 43.1	231 34.9	+ 3 39.3	198 32.7	+15 21.3	34 46.6	− 7 57.4	174 57.3	76	+26 23.7	+ 39
7	255 54.2	241 06.0	44.1	246 35.6	40.1	213 34.9	21.5	49 49.1	57.3	189 23.9	77	26 27.6	+ 37
8	270 56.7	256 06.7	45.2	261 36.4	40.8	228 37.0	21.6	64 51.6	57.3	203 50.6	77	26 31.3	+ 36
9	285 59.2	271 07.5	46.3	276 37.1	41.6	243 39.1	21.7	79 54.2	57.3	218 17.3	77	+26 34.9	+ 34
10	301 01.6	286 08.2	47.4	291 37.9	42.4	258 41.2	21.8	94 56.7	57.2	232 44.0	77	26 38.3	+ 33
11	316 04.1	301 08.9	48.5	306 38.6	43.1	273 43.3	21.9	109 59.2	57.2	247 10.7	77	26 41.6	+ 31
12	331 06.6	316 09.6	+ 9 49.5	321 39.4	+ 3 43.9	288 45.4	+15 22.0	125 01.7	− 7 57.1	261 37.4	77	+26 44.7	+ 30
13	346 09.0	331 10.4	50.6	336 40.1	44.7	303 47.6	22.1	140 04.3	57.1	276 04.1	77	26 47.7	+ 28
14	1 11.5	346 11.1	51.7	351 40.9	45.4	318 49.7	22.3	155 06.8	57.1	290 30.8	77	26 50.5	+ 27
15	16 14.0	1 11.8	52.8	6 41.6	46.2	333 51.8	22.4	170 09.3	57.0	304 57.5	77	+26 53.2	+ 25
16	31 16.4	16 12.6	53.8	21 42.4	47.0	348 53.9	22.5	185 11.9	57.0	319 24.2	78	26 55.7	+ 24
17	46 18.9	31 13.3	54.9	36 43.1	47.7	3 56.0	22.6	200 14.4	57.0	333 51.0	77	26 58.1	+ 22
18	61 21.4	46 14.1	+ 9 56.0	51 43.9	+ 3 48.5	18 58.1	+15 22.7	215 16.9	− 7 56.9	348 17.7	78	+27 00.3	+ 20
19	76 23.8	61 14.8	57.1	66 44.6	49.3	34 00.2	22.8	230 19.4	56.9	2 44.5	78	27 02.3	+ 19
20	91 26.3	76 15.5	58.1	81 45.4	50.0	49 02.4	22.9	245 22.0	56.9	17 11.3	78	27 04.2	+ 18
21	106 28.7	91 16.3	+ 9 59.2	96 46.1	50.8	64 04.5	23.0	260 24.5	56.8	31 38.1	78	+27 06.0	+ 16
22	121 31.2	106 17.0	10 00.3	111 46.9	51.6	79 06.6	23.2	275 27.0	56.8	46 04.9	79	27 07.6	+ 14
23	136 33.7	121 17.8	01.4	126 47.6	52.3	94 08.7	23.3	290 29.6	56.8	60 31.8	79	27 09.0	+ 13
22 0	151 36.1	136 18.5	+10 02.4	141 48.4	+ 3 53.1	109 10.8	+15 23.4	305 32.1	− 7 56.7	74 58.7	79	+27 10.3	+ 12
1	166 38.6	151 19.3	03.5	156 49.1	53.8	124 12.9	23.5	320 34.6	56.7	89 25.6	79	27 11.5	+ 10
2	181 41.1	166 20.0	04.6	171 49.9	54.6	139 15.0	23.6	335 37.1	56.7	103 52.5	79	27 12.5	+ 8
3	196 43.5	181 20.8	05.6	186 50.6	55.4	154 17.2	23.7	350 39.7	56.6	118 19.4	80	+27 13.3	+ 7
4	211 46.0	196 21.5	06.7	201 51.4	56.1	169 19.3	23.8	5 42.2	56.6	132 46.4	80	27 14.0	+ 6
5	226 48.5	211 22.3	07.8	216 52.1	56.9	184 21.4	24.0	20 44.7	56.6	147 13.4	80	27 14.6	+ 4
6	241 50.9	226 23.0	+10 08.8	231 52.9	+ 3 57.7	199 23.5	+15 24.1	35 47.3	− 7 56.5	161 40.4	81	+27 15.0	+ 2
7	256 53.4	241 23.8	09.9	246 53.6	58.4	214 25.6	24.2	50 49.8	56.5	176 07.5	81	27 15.2	+ 1
8	271 55.8	256 24.5	11.0	261 54.3	3 59.2	229 27.7	24.3	65 52.3	56.4	190 34.6	81	27 15.3	0
9	286 58.3	271 25.3	12.0	276 55.1	4 00.0	244 29.8	24.4	80 54.9	56.4	205 01.7	81	+27 15.3	− 2
10	302 00.8	286 26.1	13.1	291 55.8	00.7	259 31.9	24.5	95 57.4	56.4	219 28.8	82	27 15.1	− 4
11	317 03.2	301 26.8	14.2	306 56.6	01.5	274 34.0	24.7	110 59.9	56.3	233 56.0	83	27 14.7	− 5
12	332 05.7	316 27.6	+10 15.2	321 57.3	+ 4 02.3	289 36.2	+15 24.8	126 02.4	− 7 56.3	248 23.3	82	+27 14.2	− 6
13	347 08.2	331 28.4	16.3	336 58.1	03.0	304 38.3	24.9	141 05.0	56.3	262 50.5	83	27 13.6	− 8
14	2 10.6	346 29.1	17.4	351 58.8	03.8	319 40.4	25.0	156 07.5	56.2	277 17.8	84	27 12.8	− 9
15	17 13.1	1 29.9	18.4	6 59.6	04.6	334 42.5	25.1	171 10.0	56.2	291 45.2	84	+27 11.9	− 11
16	32 15.6	16 30.7	19.5	22 00.3	05.3	349 44.6	25.2	186 12.6	56.2	306 12.6	84	27 10.8	− 12
17	47 18.0	31 31.4	20.5	37 01.1	06.1	4 46.7	25.3	201 15.1	56.1	320 40.0	85	27 09.6	− 14
18	62 20.5	46 32.2	+10 21.6	52 01.8	+ 4 06.8	19 48.8	+15 25.5	216 17.6	− 7 56.1	335 07.5	85	+27 08.2	− 15
19	77 23.0	61 33.0	22.7	67 02.6	07.6	34 50.9	25.6	231 20.2	56.0	349 35.0	86	27 06.7	− 16
20	92 25.4	76 33.8	23.7	82 03.3	08.4	49 53.0	25.7	246 22.7	56.0	4 02.6	86	27 05.1	− 18
21	107 27.9	91 34.5	24.8	97 04.1	09.1	64 55.1	25.8	261 25.2	56.0	18 30.2	86	+27 03.3	− 19
22	122 30.3	106 35.3	25.8	112 04.8	09.9	79 57.3	25.9	276 27.8	55.9	32 57.8	87	27 01.4	− 21
23	137 32.8	121 36.1	26.9	127 05.6	10.7	94 59.4	26.0	291 30.3	55.9	47 25.5	88	26 59.3	− 22
23 0	152 35.3	136 36.9	+10 27.9	142 06.3	+ 4 11.4	110 01.5	+15 26.1	306 32.8	− 7 55.9	61 53.3	88	+26 57.1	− 23
1	167 37.7	151 37.7	29.0	157 07.1	12.2	125 03.6	26.3	321 35.4	55.8	76 21.1	89	26 54.8	− 25
2	182 40.2	166 38.4	30.0	172 07.8	13.0	140 05.7	26.4	336 37.9	55.8	90 49.0	89	26 52.3	− 26
3	197 42.7	181 39.2	31.1	187 08.6	13.7	155 07.8	26.5	351 40.4	55.8	105 16.9	90	+26 49.7	− 28
4	212 45.1	196 40.0	32.2	202 09.3	14.5	170 09.9	26.6	6 43.0	55.7	119 44.9	90	26 46.9	− 29
5	227 47.6	211 40.8	33.2	217 10.1	15.2	185 12.0	26.7	21 45.5	55.7	134 12.9	91	26 44.0	− 30
6	242 50.1	226 41.6	+10 34.3	232 10.8	+ 4 16.0	200 14.1	+15 26.8	36 48.0	− 7 55.6	148 41.0	91	+26 41.0	− 32
7	257 52.5	241 42.4	35.3	247 11.6	16.8	215 16.2	27.0	51 50.6	55.6	163 09.1	92	26 37.8	− 33
8	272 55.0	256 43.2	36.4	262 12.3	17.5	230 18.3	27.1	66 53.1	55.6	177 37.3	93	26 34.5	− 34
9	287 57.5	271 44.0	37.4	277 13.1	18.3	245 20.4	27.2	81 55.6	55.5	192 05.6	93	+26 31.1	− 36
10	302 59.9	286 44.8	38.5	292 13.8	19.1	260 22.5	27.3	96 58.2	55.5	206 33.9	94	26 27.5	− 37
11	318 02.4	301 45.6	39.5	307 14.6	19.8	275 24.6	27.4	112 00.7	55.5	221 02.3	94	26 23.8	− 39
12	333 04.8	316 46.4	+10 40.6	322 15.3	+ 4 20.6	290 26.7	+15 27.5	127 03.2	− 7 55.4	235 30.7	95	+26 19.9	− 39
13	348 07.3	331 47.2	41.6	337 16.1	21.3	305 28.9	27.7	142 05.8	55.4	249 59.2	96	26 16.0	− 41
14	3 09.8	346 48.0	42.6	352 16.8	22.1	320 31.0	27.8	157 08.3	55.3	264 27.8	96	26 11.9	− 42
15	18 12.2	1 48.8	43.7	7 17.5	22.9	335 33.1	27.9	172 10.8	55.3	278 56.4	97	+26 07.7	− 44
16	33 14.7	16 49.6	44.7	22 18.3	23.6	350 35.2	28.0	187 13.4	55.3	293 25.1	98	26 03.3	− 45
17	48 17.2	31 50.4	45.8	37 19.0	24.4	5 37.3	28.1	202 15.9	55.2	307 53.9	98	25 58.8	− 46
18	63 19.6	46 51.2	+10 46.8	52 19.8	+ 4 25.1	20 39.4	+15 28.2	217 18.4	− 7 55.2	322 22.7	99	+25 54.2	− 47
19	78 22.1	61 52.0	47.9	67 20.5	25.9	35 41.5	28.4	232 21.0	55.2	336 51.6	100	25 49.5	− 49
20	93 24.6	76 52.8	48.9	82 21.3	26.7	50 43.6	28.5	247 23.5	55.1	351 20.6	100	25 44.6	− 50
21	108 27.0	91 53.6	50.0	97 22.0	27.4	65 45.7	28.6	262 26.1	55.1	5 49.6	101	+25 39.6	− 51
22	123 29.5	106 54.4	51.0	112 22.8	28.2	80 47.8	28.7	277 28.6	55.0	20 18.7	101	25 34.5	− 52
23	138 32.0	121 55.3	52.0	127 23.5	28.9	95 49.9	28.8	292 31.1	55.0	34 47.8	103	25 29.3	− 53
24	153 34.4	136 56.1	+10 53.1	142 24.3	+ 4 29.7	110 52.0	+15 28.9	307 33.7	− 7 55.0	49 17.1	103	+25 24.0	− 55
code	−	+ 8	+ 11	+ 8	+ 7	+ 21	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
21 0	176 33.2	−10 44.5
1	191 33.3	43.6
2	206 33.3	42.7
3	221 33.4	41.8
4	236 33.5	40.8
5	251 33.6	39.9
6	266 33.6	−10 39.0
7	281 33.7	38.1
8	296 33.8	37.2
9	311 33.9	36.3
10	326 33.9	35.4
11	341 34.0	34.5
12	356 34.1	−10 33.6
13	11 34.1	32.7
14	26 34.2	31.8
15	41 34.3	30.9
16	56 34.4	30.0
17	71 34.4	29.1
18	86 34.5	−10 28.2
19	101 34.6	27.3
20	116 34.7	26.4
21	131 34.7	25.5
22	146 34.8	24.6
23	161 34.9	23.7
22 0	176 35.0	−10 22.7
1	191 35.1	21.8
2	206 35.1	20.9
3	221 35.2	20.0
4	236 35.3	19.1
5	251 35.4	18.2
6	266 35.4	−10 17.3
7	281 35.5	16.4
8	296 35.6	15.5
9	311 35.7	14.6
10	326 35.8	13.7
11	341 35.8	12.7
12	356 35.9	−10 11.8
13	11 36.0	10.9
14	26 36.1	10.0
15	41 36.2	09.1
16	56 36.3	08.2
17	71 36.3	07.3
18	86 36.4	−10 06.4
19	101 36.5	05.4
20	116 36.6	04.5
21	131 36.7	03.6
22	146 36.8	02.7
23	161 36.8	01.8
23 0	176 36.9	−10 00.9
1	191 37.0	10 00.0
2	206 37.1	9 59.1
3	221 37.2	58.1
4	236 37.3	57.2
5	251 37.3	56.3
6	266 37.4	− 9 55.4
7	281 37.5	54.5
8	296 37.6	53.6
9	311 37.7	52.6
10	326 37.8	51.7
11	341 37.9	50.8
12	356 38.0	− 9 49.9
13	11 38.0	49.0
14	26 38.1	48.1
15	41 38.2	47.1
16	56 38.3	46.2
17	71 38.4	45.3
18	86 38.5	− 9 44.4
19	101 38.6	43.5
20	116 38.7	42.5
21	131 38.7	41.6
22	146 38.8	40.7
23	161 38.9	39.8
24	176 39.0	− 9 38.9
code	−	+ 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.5	−57 28.6
30	Acrux	173 59.7	−62 50.4
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.6	+56 12.5
34	Alkaid	153 34.0	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.2	+26 51.9
1	Alpheratz	358 30.8	+28 50.0
51	Altair	62 52.6	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.8	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.5	−68 56.6
22	Avior	234 36.2	−59 21.6
13	Bellatrix	279 20.4	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 16.0	−52 40.3
12	Capella	281 41.2	+45 57.4
53	Deneb	50 02.8	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.5	−18 14.7
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.4	+51 29.2
54	Enif	34 31.9	+ 9 39.5
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.2	−56 51.1
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.1	−60 08.8
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 44.0	−34 24.6
40	Kochab	137 17.1	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.9	−36 08.5
24	Miapl'dus	221 48.8	−69 31.5
9	Mirfak	309 45.4	+49 42.1
50	Nunki	76 54.6	−26 21.5
52	Peacock	54 30.8	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.6	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.4	− 8 15.3
38	Rigil Kent.	140 53.6	−60 38.6
44	Sabik	103 04.5	−15 40.3
3	Schedar	350 32.9	+56 17.1
45	Shaula	97 23.5	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.4	−43 14.7
49	Vega	81 09.9	+38 44.0
39	Zub'g'bi	137 55.5	−15 51.1

GMT	Equation of Time (App.—Mean) 21	22	23
h	m s	m s	m s
0	−13 47.3	−13 40.2	−13 32.5
6	−13 45.6	−13 38.4	−13 30.5
12	−13 43.9	−13 36.4	−13 28.4
18	−13 42.1	−13 34.5	−13 26.3
24	−13 40.2	−13 32.5	−13 24.1

Lat.	Sunrise	Twlt. begins	Moonrise 21	22	23	24
N °	h m	h m	h m	h m	h m	h m
72	8 16	4 28	▭	▭	▭	▭
70	8 01	4 38	▭	▭	▭	▭
68	7 50	4 45	▭	▭	▭	▭
66	7 40	4 51	▭	▭	▭	▭
64	7 32	4 56	▭	▭	▭	10 35
62	7 25	4 59	7 48	8 20	9 38	11 15
60	7 19	5 02	8 28	9 10	10 18	11 43
58	7 14	5 05	8 56	9 41	10 46	12 05
56	7 09	5 07	9 17	10 05	11 08	12 22
54	7 05	5 09	9 35	10 24	11 26	12 37
52	7 01	5 11	9 50	10 40	11 41	12 50
50	6 58	5 12	10 03	10 54	11 54	13 01
45	6 50	5 14	10 30	11 22	12 21	13 25
40	6 44	5 15	10 52	11 44	12 42	13 44
35	6 39	5 15	11 10	12 03	13 00	13 59
30	6 34	5 15	11 25	12 19	13 15	14 13
20	6 25	5 12	11 52	12 45	13 41	14 36
10	6 17	5 07	12 14	13 09	14 03	14 55
0	6 10	5 00	12 35	13 30	14 24	15 14
10	6 03	4 52	12 57	13 52	14 44	15 32
20	5 55	4 38	13 19	14 15	15 06	15 52
30	5 46	4 21	13 46	14 42	15 32	16 15
35	5 40	4 10	14 02	14 58	15 47	16 28
40	5 34	3 56	14 20	15 16	16 04	16 43
45	5 27	3 37	14 42	15 39	16 25	17 01
50	5 19	3 13	15 10	16 07	16 51	17 24
52	5 15	2 59	15 24	16 21	17 04	17 34
54	5 10	2 45	15 40	16 37	17 18	17 46
56	5 05	2 27	15 59	16 57	17 36	18 00
58	5 00	2 02	16 23	17 20	17 56	18 16
60	4 54	1 27	16 54	17 52	18 22	18 35

Lat.	Sunset	Twlt. ends	Moonset 21	22	23	24
N °	h m	h m	h m	h m	h m	h m
72	16 14	20 05	▭	▭	▭	▭
70	16 28	19 56	▭	▭	▭	▭
68	16 39	19 48	▭	▭	▭	▭
66	16 48	19 41	▭	▭	▭	▭
64	16 56	19 36	▭	▭	▭	7 37
62	17 03	19 32	4 48	6 12	6 46	6 55
60	17 09	19 28	4 09	5 22	6 05	6 27
58	17 14	19 25	3 42	4 51	5 37	6 05
56	17 19	19 23	3 20	4 28	5 15	5 47
54	17 23	19 21	3 03	4 09	4 57	5 32
52	17 27	19 20	2 48	3 52	4 42	5 19
50	17 30	19 18	2 35	3 38	4 29	5 07
45	17 37	19 15	2 08	3 10	4 02	4 43
40	17 44	19 14	1 47	2 48	3 40	4 23
35	17 49	19 13	1 30	2 29	3 22	4 07
30	17 54	19 14	1 15	2 13	3 06	3 53
20	18 02	19 16	0 49	1 47	2 40	3 29
10	18 10	19 21	0 27	1 23	2 17	3 08
0	18 17	19 27	0 07	1 02	1 56	2 48
10	18 24	19 35	24 40	0 40	1 35	2 29
20	18 32	19 47	24 17	0 17	1 12	2 07
30	18 41	20 04	23 50	24 45	0 45	1 43
35	18 46	20 15	23 34	24 30	0 30	1 28
40	18 52	20 29	23 16	24 11	0 11	1 11
45	18 59	20 47	22 53	23 49	24 51	0 51
50	19 08	21 11	22 25	23 21	24 25	0 25
52	19 11	21 22	22 11	23 07	24 13	0 13
54	19 16	21 37	21 55	22 51	23 59	25 13
56	19 21	21 55	21 36	22 32	23 42	25 00
58	19 26	22 17	21 12	22 08	23 22	24 44
60	19 32	22 49	20 41	21 37	22 57	24 25

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
21	18 49	14 55	14 33	16 44	3 41
22	19 43	14 54	14 32	16 41	3 37
23	20 36	14 53	14 31	16 38	3 33
24	21 26	14 52	14 30	16 34	3 29

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.3	0.1
30	0.5	0.2	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	21	22	23
°	′	′	′
0	14.9	14.0	13.3
4	14.9	14.0	13.3
8	14.9	14.0	13.3
12	14.9	14.1	13.3
16	14.9	14.1	13.3
20	15.0	14.1	13.4
24	15.0	14.1	13.4
28	15.0	14.2	13.5
32	15.0	14.2	13.6
36	15.0	14.3	13.6
40	15.0	14.3	13.7
44	15.1	14.4	13.8
48	15.1	14.5	13.9
52	15.1	14.5	14.0
56	15.1	14.6	14.1
60	15.2	14.7	14.2
64	15.2	14.7	14.3
68	15.2	14.8	14.4
72	15.3	14.9	14.6
76	15.3	15.0	14.7
80	15.3	15.1	14.8
84	15.4	15.1	14.9
88	15.4	15.2	15.0
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	21	22	23
°	′	′	′
0	15.9	16.4	16.9
4	15.9	16.4	16.8
8	15.9	16.4	16.8
12	15.9	16.4	16.8
16	15.9	16.4	16.8
20	15.9	16.3	16.7
24	15.9	16.3	16.7
28	15.8	16.3	16.6
32	15.8	16.2	16.6
36	15.8	16.2	16.5
40	15.8	16.1	16.4
44	15.8	16.1	16.3
48	15.7	16.0	16.2
52	15.7	15.9	16.1
56	15.7	15.9	16.0
60	15.6	15.8	15.9
64	15.6	15.7	15.8
68	15.6	15.6	15.7
72	15.6	15.6	15.6
76	15.5	15.5	15.4
80	15.5	15.4	15.3
84	15.4	15.3	15.2
88	15.4	15.2	15.1
90			

Subtract from table, back cover

Washington's Birthday 22

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.5 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
24 0	153 34.4	136 56.1	+10 53.1	142 24.3	+ 4 29.7	110 52.0	+15 28.9	307 33.7	− 7 55.0	49 17.1	103	+25 24.0	− 55
1	168 36.9	151 56.9	54.1	157 25.0	30.5	125 54.1	29.1	322 36.2	54.9	63 46.4	104	25 18.5	− 56
2	183 39.3	166 57.7	55.2	172 25.8	31.2	140 56.2	29.2	337 38.7	54.9	78 15.8	104	25 12.9	− 57
3	198 41.8	181 58.5	•• 56.2	187 26.5	•• 32.0	155 58.3	•• 29.3	352 41.3	•• 54.8	92 45.2	105	•25 07.2	− 58
4	213 44.3	196 59.4	57.2	202 27.3	32.8	171 00.4	29.4	7 43.8	54.8	107 14.7	106	25 01.4	− 60
5	228 46.7	212 00.2	58.3	217 28.0	33.5	186 02.5	29.5	22 46.3	54.8	121 44.3	107	24 55.4	− 60
6	243 49.2	227 01.0	+10 59.3	232 28.8	+ 4 34.3	201 04.6	+15 29.6	37 48.9	− 7 54.7	136 14.0	107	+24 49.4	− 62
7	258 51.7	242 01.8	11 00.3	247 29.5	35.0	216 06.7	29.8	52 51.4	54.7	150 43.7	108	24 43.2	− 63
8	273 54.1	257 02.7	01.4	262 30.3	35.8	231 08.8	29.9	67 54.0	54.7	165 13.5	109	24 36.9	− 64
9	288 56.6	272 03.5	•• 02.4	277 31.0	•• 36.6	246 10.9	•• 30.0	82 56.5	•• 54.6	179 43.4	109	•24 30.5	− 65
10	303 59.1	287 04.3	03.4	292 31.8	37.3	261 13.0	30.1	97 59.0	54.6	194 13.3	111	24 24.0	− 67
11	319 01.5	302 05.2	04.5	307 32.5	38.1	276 15.1	30.2	113 01.6	54.5	208 43.4	111	24 17.3	− 67
12	334 04.0	317 06.0	+11 05.5	322 33.3	+ 4 38.8	291 17.2	+15 30.3	128 04.1	− 7 54.5	223 13.5	111	+24 10.6	− 69
13	349 06.4	332 06.8	06.5	337 34.0	39.6	306 19.3	30.5	143 06.7	54.5	237 43.6	113	24 03.7	− 69
14	4 08.9	347 07.7	07.6	352 34.8	40.3	321 21.4	30.6	158 09.2	54.4	252 13.9	113	23 56.8	− 71
15	19 11.4	2 08.5	•• 08.6	7 35.5	•• 41.1	336 23.5	•• 30.7	173 11.7	•• 54.4	266 44.2	114	•23 49.7	− 72
16	34 13.8	17 09.3	09.6	22 36.3	41.9	351 25.6	30.8	188 14.3	54.3	281 14.6	115	23 42.5	− 72
17	49 16.3	32 10.2	10.6	37 37.0	42.6	6 27.7	30.9	203 16.8	54.3	295 45.1	115	23 35.3	− 74
18	64 18.8	47 11.0	+11 11.7	52 37.8	+ 4 43.4	21 29.8	+15 31.0	218 19.3	− 7 54.3	310 15.6	116	+23 27.9	− 75
19	79 21.2	62 11.9	12.7	67 38.5	44.1	36 31.9	31.2	233 21.9	54.2	324 46.2	117	23 20.4	− 76
20	94 23.7	77 12.7	13.7	82 39.3	44.9	51 34.0	31.3	248 24.4	54.2	339 16.9	118	23 12.8	− 77
21	109 26.2	92 13.6	•• 14.8	97 40.0	•• 45.7	66 36.1	•• 31.4	263 27.0	•• 54.2	353 47.7	119	•23 05.1	− 78
22	124 28.6	107 14.4	15.8	112 40.7	46.4	81 38.2	31.5	278 29.5	54.1	8 18.6	119	22 57.3	− 79
23	139 31.1	122 15.3	16.8	127 41.5	47.2	96 40.3	31.6	293 32.0	54.1	22 49.5	120	22 49.4	− 80
25 0	154 33.6	137 16.1	+11 17.8	142 42.2	+ 4 47.9	111 42.4	+15 31.8	308 34.6	− 7 54.0	37 20.5	120	+22 41.4	− 81
1	169 36.0	152 17.0	18.8	157 43.0	48.7	126 44.5	31.9	323 37.1	54.0	51 51.5	122	22 33.3	− 82
2	184 38.5	167 17.8	19.9	172 43.7	49.5	141 46.6	32.0	338 39.7	54.0	66 22.7	122	22 25.1	− 83
3	199 40.9	182 18.7	•• 20.9	187 44.5	•• 50.2	156 48.7	•• 32.1	353 42.2	•• 53.9	80 53.9	123	•22 16.8	− 84
4	214 43.4	197 19.6	21.9	202 45.2	51.0	171 50.7	32.2	8 44.7	53.9	95 25.2	124	22 08.4	− 84
5	229 45.9	212 20.4	22.9	217 46.0	51.7	186 52.8	32.3	23 47.3	53.8	109 56.6	124	22 00.0	− 86
6	244 48.3	227 21.3	+11 24.0	232 46.7	+ 4 52.5	201 54.9	+15 32.5	38 49.8	− 7 53.8	124 28.0	126	+21 51.4	− 87
7	259 50.8	242 22.1	25.0	247 47.5	53.2	216 57.0	32.6	53 52.4	53.8	138 59.6	126	21 42.7	− 87
8	274 53.3	257 23.0	26.0	262 48.2	54.0	231 59.1	32.7	68 54.9	53.7	153 31.2	126	21 34.0	− 89
9	289 55.7	272 23.9	•• 27.0	277 49.0	•• 54.8	247 01.2	•• 32.8	83 57.5	•• 53.7	168 02.8	128	•21 25.1	− 89
10	304 58.2	287 24.7	28.0	292 49.7	55.5	262 03.3	32.9	99 00.0	53.6	182 34.6	128	21 16.2	− 91
11	320 00.7	302 25.6	29.0	307 50.5	56.3	277 05.4	33.1	114 02.5	53.6	197 06.4	129	21 07.1	− 91
12	335 03.1	317 26.5	+11 30.1	322 51.2	+ 4 57.0	292 07.5	+15 33.2	129 05.1	− 7 53.6	211 38.3	129	+20 58.0	− 92
13	350 05.6	332 27.4	31.1	337 52.0	57.8	307 09.6	33.3	144 07.6	53.5	226 10.2	131	20 48.8	− 93
14	5 08.1	347 28.2	32.1	352 52.7	58.5	322 11.7	33.4	159 10.2	53.5	240 42.3	131	20 39.5	− 93
15	20 10.5	2 29.1	•• 33.1	7 53.5	• 4 59.3	337 13.8	•• 33.5	174 12.7	•• 53.4	255 14.4	132	•20 30.2	− 95
16	35 13.0	17 30.0	34.1	22 54.2	5 00.0	352 15.9	33.6	189 15.3	53.4	269 46.6	132	20 20.7	− 96
17	50 15.4	32 30.9	35.1	37 55.0	00.8	7 18.0	33.8	204 17.8	53.4	284 18.8	133	20 11.1	− 96
18	65 17.9	47 31.8	+11 36.1	52 55.7	+ 5 01.6	22 20.1	+15 33.9	219 20.3	− 7 53.3	298 51.1	134	+20 01.5	− 97
19	80 20.4	62 32.6	37.1	67 56.5	02.3	37 22.2	34.0	234 22.9	53.3	313 23.5	135	19 51.8	− 98
20	95 22.8	77 33.5	38.1	82 57.2	03.1	52 24.2	34.1	249 25.4	53.2	327 56.0	136	19 42.0	− 98
21	110 25.3	92 34.4	•• 39.2	97 58.0	•• 03.8	67 26.3	•• 34.2	264 28.0	•• 53.2	342 28.6	136	•19 32.2	− 100
22	125 27.8	107 35.3	40.2	112 58.7	04.6	82 28.4	34.4	279 30.5	53.2	357 01.2	136	19 22.2	− 100
23	140 30.2	122 36.2	41.2	127 59.5	05.3	97 30.5	34.5	294 33.1	53.1	11 33.8	138	19 12.2	− 101
26 0	155 32.7	137 37.1	+11 42.2	143 00.2	+ 5 06.1	112 32.6	+15 34.6	309 35.6	− 7 53.1	26 06.6	138	+19 02.1	− 102
1	170 35.2	152 38.0	43.2	158 01.0	06.9	127 34.7	34.7	324 38.1	53.0	40 39.4	139	18 51.9	− 103
2	185 37.6	167 38.9	44.2	173 01.7	07.6	142 36.8	34.8	339 40.7	53.0	55 12.3	139	18 41.6	− 103
3	200 40.1	182 39.8	•• 45.2	188 02.5	•• 08.4	157 38.9	•• 35.0	354 43.2	•• 52.9	69 45.2	141	•18 31.3	− 104
4	215 42.5	197 40.7	46.2	203 03.2	09.1	172 41.0	35.1	9 45.8	52.9	84 18.3	140	18 20.9	− 105
5	230 45.0	212 41.6	47.2	218 04.0	09.9	187 43.1	35.2	24 48.3	52.9	98 51.3	142	18 10.4	− 105
6	245 47.5	227 42.5	+11 48.2	233 04.7	+ 5 10.6	202 45.2	+15 35.3	39 50.9	− 7 52.8	113 24.5	142	+17 59.9	− 106
7	260 49.9	242 43.4	49.2	248 05.5	11.4	217 47.2	35.4	54 53.4	52.8	127 57.7	143	17 49.3	− 107
8	275 52.4	257 44.3	50.2	263 06.2	12.1	232 49.3	35.6	69 56.0	52.7	142 31.0	143	17 38.6	− 108
9	290 54.9	272 45.2	•• 51.2	278 06.9	•• 12.9	247 51.4	•• 35.7	84 58.5	•• 52.7	157 04.3	144	•17 27.8	− 108
10	305 57.3	287 46.1	52.2	293 07.7	13.6	262 53.5	35.8	100 01.0	52.7	171 37.7	145	17 17.0	− 109
11	320 59.8	302 47.0	53.2	308 08.4	14.4	277 55.6	35.9	115 03.6	52.6	186 11.2	146	17 06.1	− 109
12	336 02.3	317 47.9	+11 54.2	323 09.2	+ 5 15.2	292 57.7	+15 36.0	130 06.1	− 7 52.6	200 44.8	146	+16 55.2	− 110
13	351 04.7	332 48.8	55.2	338 09.9	15.9	307 59.8	36.2	145 08.7	52.5	215 18.4	146	16 44.2	− 111
14	6 07.2	347 49.7	56.2	353 10.7	16.7	323 01.9	36.3	160 11.2	52.5	229 52.0	147	16 33.1	− 112
15	21 09.7	2 50.7	•• 57.2	8 11.4	•• 17.4	338 03.9	•• 36.4	175 13.8	•• 52.5	244 25.7	148	•16 21.9	− 112
16	36 12.1	17 51.6	58.2	23 12.2	18.2	353 06.0	36.5	190 16.3	52.4	258 59.5	149	16 10.7	− 112
17	51 14.6	32 52.5	11 59.2	38 12.9	18.9	8 08.1	36.6	205 18.9	52.4	273 33.4	149	15 59.5	− 114
18	66 17.0	47 53.4	+12 00.2	53 13.7	+ 5 19.7	23 10.2	+15 36.8	220 21.4	− 7 52.3	288 07.3	149	+15 48.1	− 114
19	81 19.5	62 54.4	01.2	68 14.4	20.4	38 12.3	36.9	235 24.0	52.3	302 41.2	151	15 36.7	− 114
20	96 22.0	77 55.3	02.1	83 15.2	21.2	53 14.4	37.0	250 26.5	52.2	317 15.3	150	15 25.3	− 115
21	111 24.4	92 56.2	•• 03.1	98 15.9	•• 21.9	68 16.5	•• 37.1	265 29.1	•• 52.2	331 49.3	152	•15 13.8	− 116
22	126 26.9	107 57.1	04.1	113 16.7	22.7	83 18.6	37.2	280 31.6	52.2	346 23.5	152	15 02.2	− 116
23	141 29.4	122 58.1	05.1	128 17.4	23.4	98 20.6	37.4	295 34.1	52.1	0 57.7	152	14 50.6	− 117
24	156 31.8	137 59.0	+12 06.1	143 18.2	+ 5 24.2	113 22.7	+15 37.5	310 36.7	− 7 52.1	15 31.9	153	+14 38.9	− 117
code	−	+ 9	+ 10	+ 8	+ 8	+ 21	+ 1	+ 25	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
24 0	176 39.0	− 9 38.9
1	191 39.1	37.9
2	206 39.2	37.0
3	221 39.3	36.1
4	236 39.4	35.2
5	251 39.5	34.3
6	266 39.6	− 9 33.3
7	281 39.7	32.4
8	296 39.8	31.5
9	311 39.9	30.6
10	326 39.9	29.6
11	341 40.0	28.7
12	356 40.1	− 9 27.8
13	11 40.2	26.9
14	26 40.3	26.0
15	41 40.4	25.0
16	56 40.5	24.1
17	71 40.6	23.2
18	86 40.7	− 9 22.3
19	101 40.8	21.3
20	116 40.9	20.4
21	131 41.0	19.5
22	146 41.1	18.6
23	161 41.2	17.6
25 0	176 41.3	− 9 16.7
1	191 41.4	15.8
2	206 41.5	14.9
3	221 41.6	13.9
4	236 41.7	13.0
5	251 41.8	12.1
6	266 41.9	− 9 11.1
7	281 42.0	10.2
8	296 42.1	09.3
9	311 42.2	08.4
10	326 42.3	07.4
11	341 42.4	06.5
12	356 42.5	− 9 05.6
13	11 42.6	04.6
14	26 42.7	03.7
15	41 42.8	02.8
16	56 42.9	01.9
17	71 43.0	00.9
18	86 43.1	− 9 00.0
19	101 43.2	8 59.1
20	116 43.3	58.1
21	131 43.4	57.2
22	146 43.5	56.3
23	161 43.6	55.3
26 0	176 43.7	− 8 54.4
1	191 43.8	53.5
2	206 43.9	52.5
3	221 44.0	51.6
4	236 44.1	50.7
5	251 44.2	49.7
6	266 44.3	− 8 48.8
7	281 44.4	47.9
8	296 44.5	46.9
9	311 44.6	46.0
10	326 44.7	45.1
11	341 44.8	44.1
12	356 44.9	− 8 43.2
13	11 45.0	42.3
14	26 45.1	41.3
15	41 45.3	40.4
16	56 45.4	39.5
17	71 45.5	38.5
18	86 45.6	− 8 37.6
19	101 45.7	36.7
20	116 45.8	35.7
21	131 45.9	34.8
22	146 46.0	33.9
23	161 46.1	32.9
24	176 46.2	− 8 32.0
code	−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.5	−57 28.6
30	Acrux	173 59.7	−62 50.4
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.6	+56 12.5
34	Alkaid	153 34.0	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.2	+26 51.9
1	Alpheratz	358 30.8	+28 50.0
51	Altair	62 52.6	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.8	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.5	−68 56.6
22	Avior	234 36.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 16.0	−52 40.3
12	Capella	281 41.3	+45 57.4
53	Deneb	50 02.8	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.5	−18 14.7
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.4	+51 29.2
54	Enif	34 31.9	+ 9 39.4
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.1	−56 51.1
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.0	−60 08.8
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 44.0	−34 24.6
40	Kochab	137 17.0	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.9	−36 08.5
24	Miapl'dus	221 48.9	−69 31.6
9	Mirfak	309 45.4	+49 42.1
50	Nunki	76 54.5	−26 21.5
52	Peacock	54 30.8	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.5	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.6	−60 38.6
44	Sabik	103 04.5	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.5	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.5	−43 14.7
49	Vega	81 09.8	+38 44.0
39	Zub'g'bi	137 55.4	−15 51.1

GMT	Equation of Time (App.—Mean) 24	25	26
h	m s	m s	m s
0	−13 24.1	−13 15.1	−13 05.5
6	−13 21.9	−13 12.8	−13 03.0
12	−13 19.7	−13 10.4	−13 00.5
18	−13 17.4	−13 08.0	−12 57.9
24	−13 15.1	−13 05.5	−12 55.3

Lat.	Sunrise	Twlt. begins	Moonrise 24	25	26	27
N °	h m	h m	h m	h m	h m	h m
72	7 59	4 13	▭	▭	12 03	14 46
70	7 47	4 24	▭	▭	12 58	15 07
68	7 37	4 33	▭	11 03	13 30	15 23
66	7 29	4 40	▭	11 57	13 54	15 36
64	7 22	4 45	10 35	12 30	14 12	15 47
62	7 16	4 50	11 15	12 54	14 27	15 56
60	7 11	4 55	11 43	13 12	14 40	16 04
58	7 06	4 58	12 05	13 28	14 51	16 11
56	7 02	5 01	12 22	13 41	15 00	16 17
54	6 59	5 03	12 37	13 53	15 08	16 22
52	6 55	5 04	12 50	14 03	15 16	16 27
50	6 52	5 06	13 01	14 12	15 22	16 31
45	6 45	5 09	13 25	14 31	15 36	16 41
40	6 40	5 11	13 44	14 46	15 48	16 48
35	6 35	5 12	13 59	14 59	15 58	16 55
30	6 31	5 12	14 13	15 10	16 06	17 01
20	6 23	5 10	14 36	15 29	16 21	17 11
10	6 16	5 07	14 55	15 46	16 34	17 20
0	6 10	5 00	15 14	16 01	16 46	17 28
10	6 03	4 52	15 32	16 17	16 58	17 36
20	5 56	4 41	15 52	16 33	17 10	17 45
30	5 48	4 24	16 15	16 52	17 25	17 54
35	5 43	4 13	16 28	17 03	17 33	18 00
40	5 38	4 00	16 43	17 16	17 43	18 06
45	5 31	3 43	17 01	17 30	17 54	18 14
50	5 23	3 20	17 24	17 48	18 07	18 23
52	5 20	3 09	17 34	17 56	18 13	18 27
54	5 16	2 55	17 46	18 06	18 20	18 31
56	5 12	2 38	18 00	18 16	18 28	18 36
58	5 07	2 18	18 16	18 28	18 36	18 42
60	5 01	1 51	18 35	18 42	18 46	18 48
S						

Lat.	Sunset	Twlt. ends	Moonset 24	25	26	27
N °	h m	h m	h m	h m	h m	h m
72	16 29	20 20	▭	▭	9 26	8 12
70	16 41	20 09	▭	▭	8 30	7 49
68	16 51	19 59	▭	8 50	7 56	7 31
66	16 59	19 52	▭	7 54	7 31	7 16
64	17 06	19 46	7 37	7 21	7 12	7 04
62	17 12	19 41	6 55	6 57	6 56	6 54
60	17 17	19 36	6 27	6 37	6 43	6 45
58	17 21	19 32	6 05	6 21	6 31	6 38
56	17 25	19 29	5 47	6 07	6 21	6 31
54	17 29	19 27	5 32	5 55	6 12	6 24
52	17 32	19 24	5 19	5 45	6 04	6 19
50	17 35	19 23	5 07	5 35	5 57	6 14
45	17 42	19 20	4 43	5 15	5 41	6 03
40	17 47	19 17	4 23	4 59	5 29	5 54
35	17 52	19 16	4 07	4 45	5 18	5 46
30	17 56	19 16	3 53	4 33	5 08	5 39
20	18 04	19 18	3 29	4 12	4 51	5 27
10	18 10	19 20	3 08	3 54	4 37	5 16
0	18 17	19 27	2 48	3 37	4 23	5 06
10	18 23	19 34	2 29	3 20	4 09	4 56
20	18 30	19 45	2 07	3 02	3 54	4 45
30	18 38	20 01	1 43	2 41	3 37	4 33
35	18 43	20 11	1 28	2 28	3 27	4 25
40	18 48	20 24	1 11	2 13	3 16	4 17
45	18 54	20 40	0 51	1 56	3 02	4 07
50	19 02	21 03	0 25	1 35	2 46	3 56
52	19 05	21 14	0 13	1 25	2 38	3 50
54	19 09	21 27	25 13	1 13	2 29	3 44
56	19 13	21 42	25 00	1 00	2 19	3 37
58	19 18	22 02	24 44	0 44	2 08	3 29
60	19 23	22 28	24 25	0 25	1 54	3 20
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
24	21 26	14 52	14 30	16 34	3 29
25	22 12	14 50	14 29	16 31	3 25
26	22 56	14 49	14 27	16 28	3 21
27	23 38	14 47	14 26	16 24	3 17

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.3	0.1
30	0.5	0.2	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	24	25	26
°	′	′	′
0	12.6	12.2	11.9
4	12.6	12.3	11.9
8	12.7	12.3	11.9
12	12.7	12.3	11.9
16	12.7	12.4	12.0
20	12.8	12.4	12.1
24	12.9	12.5	12.2
28	12.9	12.6	12.2
32	13.0	12.7	12.4
36	13.1	12.8	12.5
40	13.2	12.9	12.6
44	13.3	13.0	12.7
48	13.4	13.2	12.9
52	13.6	13.3	13.1
56	13.7	13.5	13.2
60	13.8	13.6	13.4
64	14.0	13.8	13.6
68	14.1	14.0	13.8
72	14.3	14.1	14.0
76	14.4	14.3	14.2
80	14.6	14.5	14.4
84	14.8	14.7	14.6
88	14.9	14.8	14.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	24	25	26
°	′	′	′
0	17.2	17.4	17.7
4	17.2	17.4	17.6
8	17.2	17.4	17.6
12	17.2	17.4	17.6
16	17.1	17.3	17.5
20	17.1	17.3	17.5
24	17.0	17.2	17.4
28	16.9	17.1	17.3
32	16.8	17.0	17.2
36	16.7	16.9	17.0
40	16.6	16.8	16.9
44	16.5	16.6	16.8
48	16.4	16.5	16.6
52	16.3	16.4	16.5
56	16.1	16.2	16.3
60	16.0	16.1	16.1
64	15.9	15.9	15.9
68	15.7	15.7	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.1	15.0	15.0
88	15.0	14.9	14.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.3 GHA	VENUS −4.3 Dec.	MARS 1.5 GHA	MARS 1.5 Dec.	JUPITER −1.8 GHA	JUPITER −1.8 Dec.	SATURN 0.6 GHA	SATURN 0.6 Dec.	MOON GHA	code	MOON Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
27 0	156 31.8	137 59.0	+12 06.1	143 18.2	+ 5 24.2	113 22.7	+15 37.5	310 36.7	− 7 52.1	15 31.9	153	+14 38.9	−117
1	171 34.3	152 59.9	07.1	158 18.9	24.9	128 24.8	37.6	325 39.2	52.0	30 06.2	154	14 27.2	−118
2	186 36.8	168 00.9	08.1	173 19.7	25.7	143 26.9	37.7	340 41.8	52.0	44 40.6	154	14 15.4	−118
3	201 39.2	183 01.8	•• 09.1	188 20.4	•• 26.5	158 29.0	•• 37.8	355 44.3	•• 52.0	59 15.0	154	•14 03.6	−119
4	216 41.7	198 02.7	10.0	203 21.2	27.2	173 31.1	38.0	10 46.9	51.9	73 49.4	155	13 51.7	−120
5	231 44.2	213 03.7	11.0	218 21.9	28.0	188 33.1	38.1	25 49.4	51.9	88 23.9	156	13 39.7	−120
6	246 46.6	228 04.6	+12 12.0	233 22.7	+ 5 28.7	203 35.2	+15 38.2	40 52.0	− 7 51.8	102 58.5	156	+13 27.7	−120
7	261 49.1	243 05.6	13.0	248 23.4	29.5	218 37.3	38.3	55 54.5	51.8	117 33.1	157	13 15.7	−121
8	276 51.5	258 06.5	14.0	263 24.2	30.2	233 39.4	38.4	70 57.1	51.7	132 07.8	157	13 03.6	−121
9	291 54.0	273 07.5	•• 15.0	278 24.9	•• 31.0	248 41.5	•• 38.6	85 59.6	•• 51.7	146 42.5	157	•12 51.5	−122
10	306 56.5	288 08.4	15.9	293 25.7	31.7	263 43.6	38.7	101 02.2	51.7	161 17.2	158	12 39.3	−122
11	321 58.9	303 09.4	16.9	308 26.4	32.5	278 45.7	38.8	116 04.7	51.6	175 52.0	159	12 27.1	−123
12	337 01.4	318 10.3	+12 17.9	323 27.1	+ 5 33.2	293 47.7	+15 38.9	131 07.3	− 7 51.6	190 26.9	159	+12 14.8	−123
13	352 03.9	333 11.3	18.9	338 27.9	34.0	308 49.8	39.0	146 09.8	51.5	205 01.8	159	12 02.5	−124
14	7 06.3	348 12.2	19.9	353 28.6	34.7	323 51.9	39.2	161 12.4	51.5	219 36.7	160	11 50.1	−124
15	22 08.8	3 13.2	•• 20.8	8 29.4	•• 35.5	338 54.0	•• 39.3	176 14.9	•• 51.4	234 11.7	160	•11 37.7	−125
16	37 11.3	18 14.1	21.8	23 30.1	36.2	353 56.1	39.4	191 17.5	51.4	248 46.7	161	11 25.2	−124
17	52 13.7	33 15.1	22.8	38 30.9	37.0	8 58.1	39.5	206 20.0	51.4	263 21.8	161	11 12.8	−126
18	67 16.2	48 16.1	+12 23.8	53 31.6	+ 5 37.7	24 00.2	+15 39.7	221 22.6	− 7 51.3	277 56.9	161	+11 00.2	−125
19	82 18.6	63 17.0	24.7	68 32.4	38.5	39 02.3	39.8	236 25.1	51.3	292 32.0	162	10 47.7	−127
20	97 21.1	78 18.0	25.7	83 33.1	39.2	54 04.4	39.9	251 27.7	51.2	307 07.2	163	10 35.0	−126
21	112 23.6	93 19.0	•• 26.7	98 33.9	•• 40.0	69 06.5	•• 40.0	266 30.2	•• 51.2	321 42.5	162	•10 22.4	−127
22	127 26.0	108 19.9	27.7	113 34.6	40.7	84 08.5	40.1	281 32.8	51.1	336 17.7	163	10 09.7	−127
23	142 28.5	123 20.9	28.6	128 35.4	41.5	99 10.6	40.3	296 35.3	51.1	350 53.0	164	9 57.0	−128
28 0	157 31.0	138 21.9	+12 29.6	143 36.1	+ 5 42.2	114 12.7	+15 40.4	311 37.9	− 7 51.1	5 28.4	164	+ 9 44.2	−127
1	172 33.4	153 22.9	30.6	158 36.9	43.0	129 14.8	40.5	326 40.4	51.0	20 03.8	164	9 31.5	−129
2	187 35.9	168 23.8	31.5	173 37.6	43.7	144 16.9	40.6	341 43.0	51.0	34 39.2	164	9 18.6	−128
3	202 38.4	183 24.8	•• 32.5	188 38.4	•• 44.5	159 18.9	•• 40.7	356 45.5	•• 50.9	49 14.6	165	• 9 05.8	−129
4	217 40.8	198 25.8	33.5	203 39.1	45.2	174 21.0	40.9	11 48.1	50.9	63 50.1	165	8 52.9	−129
5	232 43.3	213 26.8	34.4	218 39.9	46.0	189 23.1	41.0	26 50.6	50.8	78 25.6	166	8 40.0	−130
6	247 45.8	228 27.8	+12 35.4	233 40.6	+ 5 46.7	204 25.2	+15 41.1	41 53.2	− 7 50.8	93 01.2	165	+ 8 27.0	−130
7	262 48.2	243 28.7	36.4	248 41.4	47.5	219 27.3	41.2	56 55.8	50.8	107 36.7	166	8 14.0	−130
8	277 50.7	258 29.7	37.3	263 42.1	48.2	234 29.3	41.4	71 58.3	50.7	122 12.3	167	8 01.0	−130
9	292 53.1	273 30.7	•• 38.3	278 42.9	•• 49.0	249 31.4	•• 41.5	87 00.9	•• 50.7	136 48.0	166	• 7 48.0	−131
10	307 55.6	288 31.7	39.2	293 43.6	49.7	264 33.5	41.6	102 03.4	50.6	151 23.6	167	7 34.9	−131
11	322 58.1	303 32.7	40.2	308 44.4	50.5	279 35.6	41.7	117 06.0	50.6	165 59.3	167	7 21.8	−131
12	338 00.5	318 33.7	+12 41.2	323 45.1	+ 5 51.2	294 37.7	+15 41.8	132 08.5	− 7 50.5	180 35.0	168	+ 7 08.7	−132
13	353 03.0	333 34.7	42.1	338 45.9	52.0	309 39.7	42.0	147 11.1	50.5	195 10.8	168	6 55.5	−131
14	8 05.5	348 35.7	43.1	353 46.6	52.7	324 41.8	42.1	162 13.6	50.4	209 46.6	167	6 42.4	−132
15	23 07.9	3 36.7	•• 44.0	8 47.3	•• 53.5	339 43.9	•• 42.2	177 16.2	•• 50.4	224 22.3	169	• 6 29.2	−132
16	38 10.4	18 37.7	45.0	23 48.1	54.2	354 46.0	42.3	192 18.7	50.4	238 58.2	168	6 16.0	−133
17	53 12.9	33 38.7	46.0	38 48.8	55.0	9 48.0	42.5	207 21.3	50.3	253 34.0	168	6 02.7	−133
18	68 15.3	48 39.7	+12 46.9	53 49.6	+ 5 55.7	24 50.1	+15 42.6	222 23.8	− 7 50.3	268 09.8	169	+ 5 49.4	−132
19	83 17.8	63 40.7	47.9	68 50.3	56.4	39 52.2	42.7	237 26.4	50.2	282 45.7	169	5 36.2	−133
20	98 20.2	78 41.7	48.8	83 51.1	57.2	54 54.3	42.8	252 28.9	50.2	297 21.6	169	5 22.9	−134
21	113 22.7	93 42.7	•• 49.8	98 51.8	•• 57.9	69 56.3	•• 42.9	267 31.5	•• 50.1	311 57.5	170	• 5 09.5	−133
22	128 25.2	108 43.8	50.7	113 52.6	58.7	84 58.4	43.1	282 34.1	50.1	326 33.5	169	4 56.2	−134
23	143 27.6	123 44.8	51.7	128 53.3	5 59.4	100 00.5	43.2	297 36.6	50.0	341 09.4	170	4 42.8	−133
1 0	158 30.1	138 45.8	+12 52.6	143 54.1	+ 6 00.2	115 02.6	+15 43.3	312 39.2	− 7 50.0	355 45.4	169	+ 4 29.5	−134
1	173 32.6	153 46.8	53.6	158 54.8	00.9	130 04.6	43.4	327 41.7	50.0	10 21.3	170	4 16.1	−134
2	188 35.0	168 47.8	54.5	173 55.6	01.7	145 06.7	43.6	342 44.3	49.9	24 57.3	170	4 02.7	−135
3	203 37.5	183 48.8	•• 55.5	188 56.3	•• 02.4	160 08.8	•• 43.7	357 46.8	•• 49.9	39 33.3	171	• 3 49.2	−134
4	218 40.0	198 49.9	56.4	203 57.1	03.2	175 10.9	43.8	12 49.4	49.8	54 09.4	170	3 35.8	−135
5	233 42.4	213 50.9	57.4	218 57.8	03.9	190 12.9	43.9	27 51.9	49.8	68 45.4	170	3 22.3	−134
6	248 44.9	228 51.9	+12 58.3	233 58.6	+ 6 04.7	205 15.0	+15 44.1	42 54.5	− 7 49.7	83 21.4	171	+ 3 08.9	−135
7	263 47.4	243 53.0	12 59.3	248 59.3	05.4	220 17.1	44.2	57 57.1	49.7	97 57.5	170	2 55.4	−135
8	278 49.8	258 54.0	13 00.2	264 00.1	06.2	235 19.2	44.3	72 59.6	49.6	112 33.5	171	2 41.9	−135
9	293 52.3	273 55.0	•• 01.1	279 00.8	•• 06.9	250 21.2	•• 44.4	88 02.2	•• 49.6	127 09.6	171	• 2 28.4	−135
10	308 54.7	288 56.1	02.1	294 01.6	07.6	265 23.3	44.5	103 04.7	49.6	141 45.7	170	2 14.9	−135
11	323 57.2	303 57.1	03.0	309 02.3	08.4	280 25.4	44.7	118 07.3	49.5	156 21.7	171	2 01.4	−135
12	338 59.7	318 58.1	+13 04.0	324 03.0	+ 6 09.1	295 27.4	+15 44.8	133 09.8	− 7 49.5	170 57.8	171	+ 1 47.9	−136
13	354 02.1	333 59.2	04.9	339 03.8	09.9	310 29.5	44.9	148 12.4	49.4	185 33.9	171	1 34.3	−135
14	9 04.6	349 00.2	05.8	354 04.5	10.6	325 31.6	45.0	163 14.9	49.4	200 10.0	171	1 20.8	−135
15	24 07.1	4 01.3	•• 06.8	9 05.3	•• 11.4	340 33.7	•• 45.2	178 17.5	•• 49.3	214 46.1	171	• 1 07.3	−136
16	39 09.5	19 02.3	07.7	24 06.0	12.1	355 35.7	45.3	193 20.1	49.3	229 22.2	171	0 53.7	−136
17	54 12.0	34 03.4	08.6	39 06.8	12.9	10 37.8	45.4	208 22.6	49.2	243 58.3	171	0 40.1	−135
18	69 14.5	49 04.4	+13 09.6	54 07.5	+ 6 13.6	25 39.9	+15 45.5	223 25.2	− 7 49.2	258 34.4	170	+ 0 26.6	−136
19	84 16.9	64 05.5	10.5	69 08.3	14.3	40 41.9	45.7	238 27.7	49.1	273 10.4	171	+ 0 13.0	−135
20	99 19.4	79 06.5	11.5	84 09.0	15.1	55 44.0	45.8	253 30.3	49.1	287 46.5	171	− 0 00.5	−136
21	114 21.9	94 07.6	•• 12.4	99 09.8	•• 15.8	70 46.1	•• 45.9	268 32.8	•• 49.1	302 22.6	171	• 0 14.1	−136
22	129 24.3	109 08.6	13.3	114 10.5	16.6	85 48.1	46.0	283 35.4	49.0	316 58.7	171	0 27.7	−135
23	144 26.8	124 09.7	14.2	129 11.3	17.3	100 50.2	46.2	298 38.0	49.0	331 34.8	170	0 41.2	−136
24	159 29.2	139 10.8	+13 15.2	144 12.0	+ 6 18.1	115 52.3	+15 46.3	313 40.5	− 7 48.9	346 10.8	171	− 0 54.8	−136
code	−	+ 10	+ 9	+ 8	+ 8	+ 20	+ 2	+ 26	0				

GMT		SUN GHA	SUN Dec.
	h	° ′	° ′
27	0	176 46.2	− 8 32.0
	1	191 46.3	31.0
	2	206 46.4	30.1
	3	221 46.6	29.2
	4	236 46.7	28.2
	5	251 46.8	27.3
	6	266 46.9	− 8 26.4
	7	281 47.0	25.4
	8	296 47.1	24.5
	9	311 47.2	23.5
	10	326 47.3	22.6
	11	341 47.4	21.7
	12	356 47.5	− 8 20.7
	13	11 47.7	19.8
	14	26 47.8	18.8
	15	41 47.9	17.9
	16	56 48.0	17.0
	17	71 48.1	16.0
	18	86 48.2	− 8 15.1
	19	101 48.3	14.1
	20	116 48.5	13.2
	21	131 48.6	12.2
	22	146 48.7	11.3
	23	161 48.8	10.4
28	0	176 48.9	− 8 09.4
	1	191 49.0	08.5
	2	206 49.1	07.5
	3	221 49.3	06.6
	4	236 49.4	05.7
	5	251 49.5	04.7
	6	266 49.6	− 8 03.8
	7	281 49.7	02.8
	8	296 49.8	01.9
	9	311 50.0	00.9
	10	326 50.1	8 00.0
	11	341 50.2	7 59.0
	12	356 50.3	− 7 58.1
	13	11 50.4	57.2
	14	26 50.5	56.2
	15	41 50.7	55.3
	16	56 50.8	54.3
	17	71 50.9	53.4
	18	86 51.0	− 7 52.4
	19	101 51.1	51.5
	20	116 51.3	50.5
	21	131 51.4	49.6
	22	146 51.5	48.6
	23	161 51.6	47.7
1	0	176 51.7	− 7 46.7
	1	191 51.9	45.8
	2	206 52.0	44.9
	3	221 52.1	43.9
	4	236 52.2	43.0
	5	251 52.3	42.0
	6	266 52.5	− 7 41.1
	7	281 52.6	40.1
	8	296 52.7	39.2
	9	311 52.8	38.2
	10	326 52.9	37.3
	11	341 53.1	36.3
	12	356 53.2	− 7 35.4
	13	11 53.3	34.4
	14	26 53.4	33.5
	15	41 53.6	32.5
	16	56 53.7	31.6
	17	71 53.8	30.6
	18	86 53.9	− 7 29.7
	19	101 54.1	28.7
	20	116 54.2	27.8
	21	131 54.3	26.8
	22	146 54.4	25.9
	23	161 54.6	24.9
	24	176 54.7	− 7 24.0
code		−	+ 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.5	−57 28.6
30	Acrux	173 59.6	−62 50.4
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.6	+56 12.5
34	Alkaid	153 34.0	+49 32.4
55	Al Na'ir	28 40.8	−47 11.4
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.2	+26 51.9
1	Alpheratz	358 30.8	+28 50.0
51	Altair	62 52.6	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.8	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.4	−68 56.6
22	Avior	234 36.2	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.1	+ 7 24.0
17	Canopus	264 16.0	−52 40.4
12	Capella	281 41.3	+45 57.4
53	Deneb	50 02.8	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.5	−18 14.7
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 07.3	+51 29.2
54	Enif	34 31.9	+ 9 39.4
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.1	−56 51.1
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.0	−60 08.9
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.9	−34 24.6
40	Kochab	137 16.9	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.8	−36 08.5
24	Miapl'dus	221 48.9	−69 31.6
9	Mirfak	309 45.4	+49 42.1
50	Nunki	76 54.5	−26 21.5
52	Peacock	54 30.8	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.5	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.5	−60 38.6
44	Sabik	103 04.5	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.5	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.7
49	Vega	81 09.8	+38 44.0
39	Zub'g'bi	137 55.4	−15 51.1

GMT	Equation of Time (App.—Mean) 27	28	1
h	m s	m s	m s
0	−12 55.3	−12 44.6	−12 33.3
6	−12 52.7	−12 41.8	−12 30.4
12	−12 50.0	−12 39.0	−12 27.5
18	−12 47.3	−12 36.2	−12 24.5
24	−12 44.6	−12 33.3	−12 21.5

Lat.	Sunrise	Twlt. begins	Moonrise 27	28	1	2
N °	h m	h m	h m	h m	h m	h m
72	7 43	3 56	14 46	16 50	18 45	20 39
70	7 33	4 10	15 07	16 59	18 45	20 31
68	7 25	4 21	15 23	17 06	18 45	20 24
66	7 18	4 28	15 36	17 12	18 45	20 19
64	7 12	4 35	15 47	17 17	18 46	20 14
62	7 07	4 41	15 56	17 22	18 46	20 10
60	7 02	4 46	16 04	17 25	18 46	20 06
58	6 58	4 50	16 11	17 29	18 46	20 03
56	6 55	4 53	16 17	17 32	18 46	20 00
54	6 52	4 56	16 22	17 35	18 46	19 58
52	6 49	4 59	16 27	17 37	18 46	19 56
50	6 46	5 00	16 31	17 39	18 46	19 54
45	6 40	5 04	16 41	17 44	18 46	19 49
40	6 35	5 07	16 48	17 48	18 47	19 46
35	6 31	5 08	16 55	17 51	18 47	19 42
30	6 28	5 08	17 01	17 54	18 47	19 40
20	6 21	5 09	17 11	17 59	18 47	19 35
10	6 15	5 05	17 20	18 04	18 47	19 31
0	6 09	5 00	17 28	18 08	18 47	19 27
10	6 04	4 53	17 36	18 12	18 48	19 23
20	5 57	4 42	17 45	18 17	18 48	19 19
30	5 50	4 27	17 54	18 22	18 48	19 15
35	5 46	4 17	18 00	18 25	18 48	19 12
40	5 41	4 05	18 06	18 28	18 48	19 09
45	5 36	3 49	18 14	18 32	18 49	19 06
50	5 29	3 28	18 23	18 36	18 49	19 02
52	5 26	3 17	18 27	18 38	18 49	19 00
54	5 22	3 04	18 31	18 41	18 49	18 58
56	5 19	2 50	18 36	18 43	18 49	18 56
58	5 14	2 31	18 42	18 46	18 49	18 53
60	5 09	2 07	18 48	18 49	18 50	18 50
S						

Lat.	Sunset	Twlt. ends	Moonset 27	28	1.	2
N °	h m	h m	h m	h m	h m	h m
72	16 44	20 37	8 12	7 33	7 03	6. 35
70	16 54	20 22	7 49	7 22	6 59	6 38
68	17 02	20 11	7 31	7 13	6 56	6 41
66	17 09	20 02	7 16	7 05	6 54	6 43
64	17 15	19 55	7 04	6 58	6 52	6 45
62	17 20	19 49	6 54	6 52	6 50	6 47
60	17 24	19 43	6 45	6 47	6 48	6 48
58	17 28	19 39	6 38	6 42	6 46	6 50
56	17 32	19 36	6 31	6 38	6 45	6 51
54	17 35	19 33	6 24	6 35	6 44	6 52
52	17 38	19 30	6 19	6 31	6 42	6 53
50	17 40	19 28	6 14	6 28	6 41	6 54
45	17 46	19 24	6 03	6 22	6 39	6 56
40	17 51	19 21	5 54	6 16	6 37	6 58
35	17 55	19 19	5 46	6 12	6 36	6 59
30	17 58	19 18	5 39	6 07	6 34	7 00
20	18 05	19 18	5 27	6 00	6 31	7 02
10	18 11	19 21	5 16	5 53	6 29	7 04
0	18 16	19 25	5 06	5 47	6 27	7 06
10	18 22	19 33	4 56	5 41	6 25	7 08
20	18 28	19 43	4 45	5 34	6 22	7 10
30	18 35	19 57	4 33	5 27	6 20	7 12
35	18 39	20 07	4 25	5 22	6 18	7 14
40	18 43	20 18	4 17	5 17	6 16	7 15
45	18 49	20 34	4 07	5 11	6 14	7 17
50	18 55	20 54	3 56	5 04	6 12	7 19
52	18 58	21 04	3 50	5 01	6 10	7 20
54	19 02	21 16	3 44	4 57	6 09	7 21
56	19 06	21 31	3 37	4 53	6 08	7 22
58	19 10	21 48	3 29	4 49	6 06	7 23
60	19 14	22 09	3 20	4 44	6 04	7 24
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
27	23 38	14 47	14 26	16 24	3 17
28	24 17	14 46	14 25	16 21	3 13
1	0 17	14 44	14 24	16 18	3 09
2	0 57	14 42	14 23	16 14	3 05

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.3	0.1
30	0.5	0.2	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	27	28	1
°	′	′	′
0	11.7	11.7	11.7
4	11.7	11.7	11.7
8	11.8	11.8	11.8
12	11.8	11.8	11.8
16	11.9	11.9	11.9
20	12.0	12.0	12.0
24	12.0	12.0	12.0
28	12.1	12.1	12.1
32	12.2	12.2	12.2
36	12.4	12.4	12.4
40	12.5	12.5	12.5
44	12.6	12.6	12.6
48	12.8	12.8	12.8
52	13.0	13.0	13.0
56	13.1	13.1	13.1
60	13.3	13.3	13.3
64	13.5	13.5	13.5
68	13.7	13.7	13.7
72	13.9	13.9	13.9
76	14.1	14.1	14.1
80	14.3	14.3	14.3
84	14.5	14.5	14.5
88	14.7	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	27	28	1
°	′	′	′
0	17.7	17.7	17.7
4	17.7	17.7	17.7
8	17.7	17.7	17.7
12	17.6	17.6	17.6
16	17.6	17.6	17.6
20	17.5	17.5	17.5
24	17.4	17.4	17.4
28	17.3	17.3	17.3
32	17.2	17.2	17.2
36	17.1	17.1	17.1
40	17.0	17.0	17.0
44	16.8	16.8	16.8
48	16.7	16.7	16.7
52	16.5	16.5	16.5
56	16.3	16.3	16.3
60	16.1	16.1	16.1
64	16.0	16.0	16.0
68	15.8	15.8	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15 4
80	15.2	15.2	15.2
84	14.9	14.9	14.9
88	14.8	14.8	14.8
90			

Subtract from table, back cover

Full Moon 28

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.5 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
2 0	159 29.2	139 10.8	+13 15.2	144 12.0	+ 6 18.1	115 52.3	+15 46.3	313 40.5	− 7 48.9	346 10.8	171	− 0 54.8	−136
1	174 31.7	154 11.8	16.1	159 12.8	18.8	130 54.4	46.4	328 43.1	48.9	0 46.9	170	1 08.4	−135
2	189 34.2	169 12.9	17.0	174 13.5	19.6	145 56.4	46.5	343 45.6	48.8	15 22.9	171	1 21.9	−136
3	204 36.6	184 14.0	•• 18.0	189 14.3	•• 20.3	160 58.5	•• 46.6	358 48.2	•• 48.8	29 59.0	170	• 1 35.5	−135
4	219 39.1	199 15.0	18.9	204 15.0	21.0	176 00.6	46.8	13 50.8	48.7	44 35.0	170	1 49.0	−136
5	234 41.6	214 16.1	19.8	219 15.8	21.8	191 02.6	46.9	28 53.3	48.7	59 11.0	170	2 02.6	−135
6	249 44.0	229 17.2	+13 20.7	234 16.5	+ 6 22.5	206 04.7	+15 47.0	43 55.9	− 7 48.6	73 47.0	170	− 2 16.1	−136
7	264 46.5	244 18.3	21.7	249 17.3	23.3	221 06.8	47.1	58 58.4	48.6	88 23.0	170	2 29.7	−135
8	279 49.0	259 19.3	22.6	264 18.0	24.0	236 08.8	47.3	74 01.0	48.6	102 59.0	170	2 43.2	−135
9	294 51.4	274 20.4	•• 23.5	279 18.7	•• 24.8	251 10.9	•• 47.4	89 03.6	•• 48.5	117 35.0	169	• 2 56.7	−136
10	309 53.9	289 21.5	24.4	294 19.5	25.5	266 13.0	47.5	104 06.1	48.5	132 10.9	169	3 10.3	−135
11	324 56.3	304 22.6	25.4	309 20.2	26.2	281 15.0	47.6	119 08.7	48.4	146 46.8	170	3 23.8	−135
12	339 58.8	319 23.7	+13 26.3	324 21.0	+ 6 27.0	296 17.1	+15 47.8	134 11.2	− 7 48.4	161 22.8	169	− 3 37.3	−134
13	355 01.3	334 24.8	27.2	339 21.7	27.7	311 19.2	47.9	149 13.8	48.3	175 58.7	168	3 50.7	−135
14	10 03.7	349 25.8	28.1	354 22.5	28.5	326 21.2	48.0	164 16.4	48.3	190 34.5	169	4 04.2	−135
15	25 06.2	4 26.9	•• 29.0	9 23.2	•• 29.2	341 23.3	•• 48.1	179 18.9	•• 48.2	205 10.4	168	• 4 17.7	−134
16	40 08.7	19 28.0	29.9	24 24.0	30.0	356 25.4	48.3	194 21.5	48.2	219 46.2	168	4 31.1	−135
17	55 11.1	34 29.1	30.9	39 24.7	30.7	11 27.4	48.4	209 24.0	48.1	234 22.0	168	4 44.6	−134
18	70 13.6	49 30.2	+13 31.8	54 25.5	+ 6 31.4	26 29.5	+15 48.5	224 26.6	− 7 48.1	248 57.8	168	− 4 58.0	−134
19	85 16.1	64 31.3	32.7	69 26.2	32.2	41 31.6	48.6	239 29.2	48.0	263 33.6	167	5 11.4	−134
20	100 18.5	79 32.4	33.6	84 27.0	32.9	56 33.6	48.8	254 31.7	48.0	278 09.3	167	5 24.8	−134
21	115 21.0	94 33.5	•• 34.5	99 27.7	•• 33.7	71 35.7	•• 48.9	269 34.3	•• 47.9	292 45.0	167	• 5 38.2	−134
22	130 23.5	109 34.6	35.4	114 28.5	34.4	86 37.8	49.0	284 36.8	47.9	307 20.7	167	5 51.6	−133
23	145 25.9	124 35.7	36.3	129 29.2	35.1	101 39.8	49.1	299 39.4	47.9	321 56.4	166	6 04.9	−133
3 0	160 28.4	139 36.9	+13 37.2	144 30.0	+ 6 35.9	116 41.9	+15 49.3	314 42.0	− 7 47.8	336 32.0	166	− 6 18.2	−133
1	175 30.8	154 38.0	38.1	159 30.7	36.6	131 44.0	49.4	329 44.5	47.8	351 07.6	166	6 31.5	−133
2	190 33.3	169 39.1	39.1	174 31.4	37.4	146 46.0	49.5	344 47.1	47.7	5 43.2	165	6 44.8	−133
3	205 35.8	184 40.2	•• 40.0	189 32.2	•• 38.1	161 48.1	•• 49.6	359 49.7	•• 47.7	20 18.7	165	• 6 58.1	−132
4	220 38.2	199 41.3	40.9	204 32.9	38.8	176 50.1	49.8	14 52.2	47.6	34 54.2	165	7 11.3	−132
5	235 40.7	214 42.4	41.8	219 33.7	39.6	191 52.2	49.9	29 54.8	47.6	49 29.7	164	7 24.5	−132
6	250 43.2	229 43.6	+13 42.7	234 34.4	+ 6 40.3	206 54.3	+15 50.0	44 57.3	− 7 47.5	64 05.1	164	− 7 37.7	−132
7	265 45.6	244 44.7	43.6	249 35.2	41.1	221 56.3	50.1	59 59.9	47.5	78 40.5	164	7 50.9	−131
8	280 48.1	259 45.8	44.5	264 35.9	41.8	236 58.4	50.3	75 02.5	47.4	93 15.9	163	8 04.0	−132
9	295 50.6	274 46.9	•• 45.4	279 36.7	•• 42.5	252 00.5	•• 50.4	90 05.0	•• 47.4	107 51.2	163	• 8 17.2	−130
10	310 53.0	289 48.1	46.3	294 37.4	43.3	267 02.5	50.5	105 07.6	47.3	122 26.5	162	8 30.2	−131
11	325 55.5	304 49.2	47.2	309 38.2	44.0	282 04.6	50.6	120 10.2	47.3	137 01.7	162	8 43.3	−131
12	340 57.9	319 50.3	+13 48.1	324 38.9	+ 6 44.8	297 06.6	+15 50.8	135 12.7	− 7 47.2	151 36.9	162	− 8 56.4	−130
13	356 00.4	334 51.5	49.0	339 39.7	45.5	312 08.7	50.9	150 15.3	47.2	166 12.1	161	9 09.4	−129
14	11 02.9	349 52.6	49.9	354 40.4	46.2	327 10.8	51.0	165 17.9	47.1	180 47.2	161	9 22.3	−130
15	26 05.3	4 53.8	•• 50.8	9 41.2	•• 47.0	342 12.8	•• 51.1	180 20.4	•• 47.1	195 22.3	160	• 9 35.3	−129
16	41 07.8	19 54.9	51.7	24 41.9	47.7	357 14.9	51.3	195 23.0	47.1	209 57.3	160	9 48.2	−129
17	56 10.3	34 56.0	52.6	39 42.7	48.5	12 17.0	51.4	210 25.5	47.0	224 32.3	160	10 01.1	−128
18	71 12.7	49 57.2	+13 53.5	54 43.4	+ 6 49.2	27 19.0	+15 51.5	225 28.1	− 7 47.0	239 07.3	159	−10 13.9	−128
19	86 15.2	64 58.3	54.3	69 44.1	49.9	42 21.1	51.6	240 30.7	46.9	253 42.2	158	10 26.7	−128
20	101 17.7	79 59.5	55.2	84 44.9	50.7	57 23.1	51.8	255 33.2	46.9	268 17.0	158	10 39.5	−128
21	116 20.1	95 00.6	•• 56.1	99 45.6	•• 51.4	72 25.2	•• 51.9	270 35.8	•• 46.8	282 51.8	157	•10 52.3	−127
22	131 22.6	110 01.8	57.0	114 46.4	52.1	87 27.2	52.0	285 38.4	46.8	297 26.5	157	11 05.0	−126
23	146 25.1	125 02.9	57.9	129 47.1	52.9	102 29.3	52.1	300 40.9	46.7	312 01.2	157	11 17.6	−127
4 0	161 27.5	140 04.1	+13 58.8	144 47.9	+ 6 53.6	117 31.4	+15 52.3	315 43.5	− 7 46.7	326 35.9	156	−11 30.3	−126
1	176 30.0	155 05.3	13 59.7	159 48.6	54.4	132 33.4	52.4	330 46.1	46.6	341 10.5	155	11 42.9	−125
2	191 32.4	170 06.4	14 00.6	174 49.4	55.1	147 35.5	52.5	345 48.6	46.6	355 45.0	155	11 55.4	−125
3	206 34.9	185 07.6	•• 01.4	189 50.1	•• 55.8	162 37.5	•• 52.6	0 51.2	•• 46.5	10 19.5	154	•12 07.9	−125
4	221 37.4	200 08.8	02.3	204 50.9	56.6	177 39.6	52.8	15 53.8	46.5	24 53.9	154	12 20.4	−124
5	236 39.8	215 09.9	03.2	219 51.6	57.3	192 41.7	52.9	30 56.3	46.4	39 28.3	153	12 32.8	−124
6	251 42.3	230 11.1	+14 04.1	234 52.4	+ 6 58.0	207 43.7	+15 53.0	45 58.9	− 7 46.4	54 02.6	153	−12 45.2	−123
7	266 44.8	245 12.3	05.0	249 53.1	58.8	222 45.8	53.2	61 01.5	46.3	68 36.9	152	12 57.5	−123
8	281 47.2	260 13.5	05.9	264 53.8	6 59.5	237 47.8	53.3	76 04.0	46.3	83 11.1	151	13 09.8	−123
9	296 49.7	275 14.6	•• 06.7	279 54.6	• 7 00.2	252 49.9	•• 53.4	91 06.6	•• 46.2	97 45.2	151	•13 22.1	−122
10	311 52.2	290 15.8	07.6	294 55.3	01.0	267 51.9	53.5	106 09.2	46.2	112 19.3	150	13 34.3	−121
11	326 54.6	305 17.0	08.5	309 56.1	01.7	282 54.0	53.7	121 11.7	46.1	126 53.3	150	13 46.4	−121
12	341 57.1	320 18.2	+14 09.4	324 56.8	+ 7 02.5	297 56.1	+15 53.8	136 14.3	− 7 46.1	141 27.3	149	−13 58.5	−121
13	356 59.5	335 19.4	10.2	339 57.6	03.2	312 58.1	53.9	151 16.9	46.0	156 01.2	148	14 10.6	−120
14	12 02.0	350 20.6	11.1	354 58.3	03.9	328 00.2	54.0	166 19.4	46.0	170 35.0	147	14 22.6	−119
15	27 04.5	5 21.8	•• 12.0	9 59.1	•• 04.7	343 02.2	•• 54.2	181 22.0	•• 45.9	185 08.7	147	•14 34.5	−119
16	42 06.9	20 22.9	12.9	24 59.8	05.4	358 04.3	54.3	196 24.6	45.9	199 42.4	147	14 46.4	−119
17	57 09.4	35 24.1	13.7	40 00.6	06.1	13 06.3	54.4	211 27.1	45.8	214 16.1	145	14 58.3	−117
18	72 11.9	50 25.3	+14 14.6	55 01.3	+ 7 06.9	28 08.4	+15 54.5	226 29.7	− 7 45.8	228 49.6	145	−15 10.0	−118
19	87 14.3	65 26.5	15.5	70 02.1	07.6	43 10.5	54.7	241 32.3	45.7	243 23.1	144	15 21.8	−117
20	102 16.8	80 27.7	16.3	85 02.8	08.3	58 12.5	54.8	256 34.8	45.7	257 56.5	144	15 33.5	−116
21	117 19.3	95 28.9	•• 17.2	100 03.5	•• 09.1	73 14.6	•• 54.9	271 37.4	•• 45.6	272 29.9	143	•15 45.1	−115
22	132 21.7	110 30.1	18.1	115 04.3	09.8	88 16.6	55.0	286 40.0	45.6	287 03.2	142	15 56.6	−115
23	147 24.2	125 31.4	18.9	130 05.0	10.5	103 18.7	55.2	301 42.5	45.5	301 36.4	141	16 08.1	−115
24	162 26.7	140 32.6	+14 19.8	145 05.8	+ 7 11.3	118 20.7	+15 55.3	316 45.1	− 7 45.5	316 09.5	141	−16 19.6	−113
code	−	+ 12	+ 9	+ 8	+ 7	+ 21	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
2 0	176 54.7	− 7 24.0
1	191 54.8	23.0
2	206 54.9	22.1
3	221 55.1 ••	21.1
4	236 55.2	20.2
5	251 55.3	19.2
6	266 55.4	− 7 18.3
7	281 55.6	17.3
8	296 55.7	16.3
9	311 55.8 ••	15.4
10	326 55.9	14.4
11	341 56.1	13.5
12	356 56.2	− 7 12.5
13	11 56.3	11.6
14	26 56.5	10.6
15	41 56.6 ••	09.7
16	56 56.7	08.7
17	71 56.8	07.8
18	86 57.0	− 7 06.8
19	101 57.1	05.8
20	116 57.2	04.9
21	131 57.4 ••	03.9
22	146 57.5	03.0
23	161 57.6	02.0
3 0	176 57.8	− 7 01.1
1	191 57.9	7 00.1
2	206 58.0	6 59.2
3	221 58.1 ••	58.2
4	236 58.3	57.2
5	251 58.4	56.3
6	266 58.5	− 6 55.3
7	281 58.7	54.4
8	296 58.8	53.4
9	311 58.9 ••	52.5
10	326 59.1	51.5
11	341 59.2	50.5
12	356 59.3	− 6 49.6
13	11 59.5	48.6
14	26 59.6	47.7
15	41 59.7 ••	46.7
16	56 59.9	45.8
17	72 00.0	44.8
18	87 00.1	− 6 43.8
19	102 00.3	42.9
20	117 00.4	41.9
21	132 00.5 ••	41.0
22	147 00.7	40.0
23	162 00.8	39.0
4 0	177 00.9	− 6 38.1
1	192 01.1	37.1
2	207 01.2	36.2
3	222 01.4 ••	35.2
4	237 01.5	34.2
5	252 01.6	33.3
6	267 01.8	− 6 32.3
7	282 01.9	31.4
8	297 02.0	30.4
9	312 02.2 ••	29.4
10	327 02.3	28.5
11	342 02.4	27.5
12	357 02.6	− 6 26.5
13	12 02.7	25.6
14	27 02.9	24.6
15	42 03.0 ••	23.7
16	57 03.1	22.7
17	72 03.3	21.7
18	87 03.4	− 6 20.8
19	102 03.6	19.8
20	117 03.7	18.8
21	132 03.8 ••	17.9
22	147 04.0	16.9
23	162 04.1	16.0
24	177 04.3	− 6 15.0
code	−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.5	−57 28.6
30	Acrux	173 59.6	−62 50.4
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.6	+56 12.5
34	Alkaid	153 33.9	+49 32.4
55	Al Na'ir	28 40.7	−47 11.3
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.1	+26 51.9
1	Alpheratz	358 30.8	+28 50.0
51	Altair	62 52.6	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.8	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.3	−68 56.6
22	Avior	234 36.2	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.0	−52 40.4
12	Capella	281 41.3	+45 57.4
53	Deneb	50 02.8	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.5	−18 14.7
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.3	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.1	−56 51.1
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.0	−60 08.9
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.9	−34 24.6
40	Kochab	137 16.9	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.8	−36 08.5
24	Miapl'dus	221 48.9	−69 31.6
9	Mirfak	309 45.5	+49 42.1
50	Nunki	76 54.5	−26 21.5
52	Peacock	54 30.7	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.5	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.5	−60 38.6
44	Sabik	103 04.5	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.4	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.7
49	Vega	81 09.8	+38 44.0
39	Zub'g'bi	137 55.4	−15 51.1

GMT	Equation of Time (App.—Mean) 2	3	4
h	m s	m s	m s
0	−12 21.5	−12 09.3	−11 56.5
6	−12 18.5	−12 06.1	−11 53.2
12	−12 15.4	−12 02.9	−11 49.9
18	−12 12.4	−11 59.7	−11 46.6
24	−12 09.3	−11 56.5	−11 43.3

Lat.	Sunrise	Twlt. begins	Moonrise 2	3	4	5
N °	h m	h m	h m	h m	h m	h m
72	7 27	3 39	20 39	22 44	25 27	1 27
70	7 19	3 55	20 31	22 24	24 35	0 35
68	7 12	4 07	20 24	22 08	24 03	0 03
66	7 06	4 17	20 19	21 55	23 40	25 40
64	7 01	4 25	20 14	21 45	23 22	25 07
62	6 57	4 31	20 10	21 36	23 07	24 44
60	6 53	4 37	20 06	21 29	22 55	24 25
58	6 50	4 42	20 03	21 22	22 44	24 09
56	6 47	4 46	20 00	21 16	22 35	23 56
54	6 45	4 49	19 58	21 11	22 27	23 44
52	6 42	4 52	19 56	21 07	22 19	23 34
50	6 40	4 54	19 54	21 02	22 13	23 25
45	6 35	4 59	19 49	20 53	21 59	23 06
40	6 31	5 02	19 46	20 46	21 47	22 51
35	6 27	5 05	19 42	20 39	21 38	22 38
30	6 24	5 05	19 40	20 34	21 29	22 27
20	6 19	5 06	19 35	20 24	21 15	22 08
10	6 14	5 04	19 31	20 15	21 02	21 51
0	6 09	5 00	19 27	20 07	20 50	21 36
10	6 04	4 53	19 23	20 00	20 38	21 20
20	5 58	4 43	19 19	19 51	20 26	21 04
30	5 52	4 30	19 15	19 42	20 12	20 46
35	5 49	4 21	19 12	19 37	20 04	20 35
40	5 44	4 09	19 09	19 31	19 55	20 23
45	5 40	3 54	19 06	19 24	19 44	20 08
50	5 34	3 35	19 02	19 15	19 31	19 51
52	5 31	3 25	19 00	19 11	19 25	19 42
54	5 28	3 14	18 58	19 07	19 19	19 33
56	5 25	3 01	18 56	19 03	19 11	19 23
58	5 21	2 44	18 53	18 57	19 03	19 11
60	5 17	2 24	18 50	18 52	18 54	18 58
S						

Lat.	Sunset	Twlt. ends	Moonset 2	3	4	5
N °	h m	h m	h m	h m	h m	h m
72	16 59	20 53	6 35	6 05	5 27	4 13
70	17 07	20 37	6 38	6 16	5 49	5 07
68	17 14	20 24	6 41	6 25	6 06	5 41
66	17 19	20 13	6 43	6 32	6 20	6 05
64	17 24	20 04	6 45	6 39	6 32	6 25
62	17 28	19 57	6 47	6 44	6 42	6 40
60	17 32	19 51	6 48	6 49	6 51	6 54
58	17 35	19 46	6 50	6 54	6 58	7 05
56	17 38	19 42	6 51	6 57	7 05	7 15
54	17 41	19 39	6 52	7 01	7 11	7 24
52	17 43	19 36	6 53	7 04	7 17	7 32
50	17 45	19 33	6 54	7 07	7 22	7 39
45	17 50	19 28	6 56	7 13	7 32	7 54
40	17 54	19 24	6 58	7 19	7 41	8 07
35	17 57	19 21	6 59	7 23	7 49	8 18
30	18 00	19 20	7 00	7 27	7 56	8 27
20	18 06	19 19	7 02	7 34	8 08	8 44
10	18 11	19 21	7 04	7 40	8 18	8 58
0	18 15	19 24	7 06	7 46	8 28	9 12
10	18 20	19 31	7 08	7 52	8 38	9 25
20	18 25	19 39	7 10	7 58	8 48	9 40
30	18 31	19 53	7 12	8 06	9 00	9 57
35	18 35	20 02	7 14	8 10	9 07	10 06
40	18 39	20 13	7 15	8 14	9 15	10 18
45	18 44	20 28	7 17	8 20	9 24	10 31
50	18 49	20 46	7 19	8 27	9 36	10 47
52	18 52	20 56	7 20	8 30	9 41	10 55
54	18 55	21 07	7 21	8 33	9 47	11 03
56	18 58	21 19	7 22	8 37	9 54	11 13
58	19 02	21 35	7 23	8 41	10 01	11 24
60	19 06	21 54	7 24	8 46	10 09	11 37
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
2	0 57	14 42	14 23	16 14	3 05
3	1 37	14 40	14 21	16 11	3 01
4	2 18	14 39	14 20	16 08	2 57
5	3 01	14 37	14 19	16 04	2 53

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.3	0.1
30	0.5	0.2	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	2	3	4
°	′	′	′
0	11.9	12.1	12.5
4	11.9	12.1	12.5
8	11.9	12.2	12.5
12	11.9	12.2	12.6
16	12.0	12.2	12.6
20	12.1	12.3	12.7
24	12.2	12.4	12.7
28	12.2	12.5	12.8
32	12.4	12.6	12.9
36	12.5	12.7	13.0
40	12.6	12.8	13.1
44	12.7	12.9	13.2
48	12.9	13.1	13.4
52	13.1	13.2	13.5
56	13.2	13.4	13.6
60	13.4	13.5	13.8
64	13.6	13.7	13.9
68	13.8	13.9	14.1
72	14.0	14.1	14.2
76	14.2	14.3	14.4
80	14.4	14.4	14.6
84	14.6	14.6	14.7
88	14.7	14.8	14.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	2	3	4
°	′	′	′
0	17.7	17.5	17.3
4	17.6	17.5	17.3
8	17.6	17.5	17.3
12	17.6	17.4	17.2
16	17.5	17.4	17.2
20	17.5	17.3	17.1
24	17.4	17.2	17.1
28	17.3	17.2	17.0
32	17.2	17.1	16.9
36	17.0	16.9	16.8
40	16.9	16.8	16.7
44	16.8	16.7	16.6
48	16.6	16.6	16.4
52	16.5	16.4	16.3
56	16.3	16.2	16.2
60	16.1	16.1	16.0
64	15.9	15.9	15.9
68	15.8	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.1
88	14.8	14.9	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.5 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
5 0	162 26.7	140 32.6	+14 19.8	145 05.8	+ 7 11.3	118 20.7	+15 55.3	316 45.1	− 7 45.5	316 09.5	141	−16 19.6	113
1	177 29.1	155 33.8	20.7	160 06.5	12.0	133 22.8	55.4	331 47.7	45.5	330 42.6	140	16 30.9	114
2	192 31.6	170 35.0	21.5	175 07.3	12.7	148 24.8	55.6	346 50.2	45.4	345 15.6	139	16 42.3	112
3	207 34.0	185 36.2	22.4	190 08.0	13.5	163 26.9	55.7	1 52.8	45.4	359 48.5	138	16 53.5	112
4	222 36.5	200 37.4	23.2	205 08.8	14.2	178 28.9	55.8	16 55.4	45.3	14 21.3	138	17 04.7	111
5	237 39.0	215 38.7	24.1	220 09.5	14.9	193 31.0	55.9	31 58.0	45.3	28 54.1	137	17 15.8	111
6	252 41.4	230 39.9	+14 25.0	235 10.3	+ 7 15.7	208 33.0	+15 56.1	47 00.5	− 7 45.2	43 26.8	136	−17 26.9	110
7	267 43.9	245 41.1	25.8	250 11.0	16.4	223 35.1	56.2	62 03.1	45.2	57 59.4	135	17 37.9	109
8	282 46.4	260 42.3	26.7	265 11.8	17.1	238 37.1	56.3	77 05.7	45.1	72 31.9	135	17 48.8	108
9	297 48.8	275 43.6	27.5	280 12.5	17.9	253 39.2	56.4	92 08.2	45.1	87 04.4	133	17 59.6	108
10	312 51.3	290 44.8	28.4	295 13.2	18.6	268 41.3	56.6	107 10.8	45.0	101 36.7	133	18 10.4	107
11	327 53.8	305 46.0	29.2	310 14.0	19.3	283 43.3	56.7	122 13.4	45.0	116 09.0	132	18 21.1	106
12	342 56.2	320 47.3	+14 30.1	325 14.7	+ 7 20.1	298 45.4	+15 56.8	137 15.9	− 7 44.9	130 41.2	131	−18 31.7	106
13	357 58.7	335 48.5	30.9	340 15.5	20.8	313 47.4	57.0	152 18.5	44.9	145 13.3	131	18 42.3	105
14	13 01.2	350 49.8	31.8	355 16.2	21.5	328 49.5	57.1	167 21.1	44.8	159 45.4	129	18 52.8	104
15	28 03.6	5 51.0	32.6	10 17.0	22.3	343 51.5	57.2	182 23.7	44.8	174 17.3	129	19 03.2	103
16	43 06.1	20 52.2	33.5	25 17.7	23.0	358 53.6	57.3	197 26.2	44.7	188 49.2	128	19 13.5	103
17	58 08.5	35 53.5	34.3	40 18.5	23.7	13 55.6	57.5	212 28.8	44.7	203 21.0	127	19 23.8	101
18	73 11.0	50 54.7	+14 35.2	55 19.2	+ 7 24.5	28 57.7	+15 57.6	227 31.4	− 7 44.6	217 52.7	126	−19 33.9	101
19	88 13.5	65 56.0	36.0	70 20.0	25.2	43 59.7	57.7	242 33.9	44.6	232 24.3	126	19 44.0	100
20	103 15.9	80 57.2	36.9	85 20.7	25.9	59 01.8	57.8	257 36.5	44.5	246 55.9	124	19 54.0	100
21	118 18.4	95 58.5	37.7	100 21.4	26.7	74 03.8	58.0	272 39.1	44.5	261 27.3	124	20 04.0	98
22	133 20.9	110 59.8	38.6	115 22.2	27.4	89 05.9	58.1	287 41.7	44.4	275 58.7	122	20 13.8	98
23	148 23.3	126 01.0	39.4	130 22.9	28.1	104 07.9	58.2	302 44.2	44.4	290 29.9	122	20 23.6	97
6 0	163 25.8	141 02.3	+14 40.2	145 23.7	+ 7 28.9	119 10.0	+15 58.4	317 46.8	− 7 44.3	305 01.1	121	−20 33.3	96
1	178 28.3	156 03.6	41.1	160 24.4	29.6	134 12.0	58.5	332 49.4	44.3	319 32.2	120	20 42.9	95
2	193 30.7	171 04.8	41.9	175 25.2	30.3	149 14.1	58.6	347 51.9	44.2	334 03.2	119	20 52.4	94
3	208 33.2	186 06.1	42.8	190 25.9	31.0	164 16.1	58.7	2 54.5	44.2	348 34.1	119	21 01.8	93
4	223 35.6	201 07.4	43.6	205 26.7	31.8	179 18.2	58.9	17 57.1	44.1	3 05.0	117	21 11.1	92
5	238 38.1	216 08.6	44.4	220 27.4	32.5	194 20.2	59.0	32 59.7	44.1	17 35.7	116	21 20.3	92
6	253 40.6	231 09.9	+14 45.3	235 28.2	+ 7 33.2	209 22.3	+15 59.1	48 02.2	− 7 44.0	32 06.3	116	−21 29.5	90
7	268 43.0	246 11.2	46.1	250 28.9	34.0	224 24.3	59.3	63 04.8	43.9	46 36.9	115	21 38.5	89
8	283 45.5	261 12.5	46.9	265 29.6	34.7	239 26.3	59.4	78 07.4	43.9	61 07.4	113	21 47.4	89
9	298 48.0	276 13.8	47.8	280 30.4	35.4	254 28.4	59.5	93 10.0	43.8	75 37.7	113	21 56.3	88
10	313 50.4	291 15.1	48.6	295 31.1	36.1	269 30.4	59.6	108 12.5	43.8	90 08.0	112	22 05.1	86
11	328 52.9	306 16.3	49.4	310 31.9	36.9	284 32.5	59.8	123 15.1	43.7	104 38.2	111	22 13.7	86
12	343 55.4	321 17.6	+14 50.3	325 32.6	+ 7 37.6	299 34.5	+15 59.9	138 17.7	− 7 43.7	119 08.3	110	−22 22.3	84
13	358 57.8	336 18.9	51.1	340 33.4	38.3	314 36.6	16 00.0	153 20.3	43.6	133 38.3	109	22 30.7	84
14	14 00.3	351 20.2	51.9	355 34.1	39.1	329 38.6	00.2	168 22.8	43.6	148 08.2	108	22 39.1	82
15	29 02.8	6 21.5	52.7	10 34.9	39.8	344 40.7	00.3	183 25.4	43.5	162 38.0	107	22 47.3	82
16	44 05.2	21 22.8	53.6	25 35.6	40.5	359 42.7	00.4	198 28.0	43.5	177 07.7	106	22 55.5	80
17	59 07.7	36 24.1	54.4	40 36.3	41.2	14 44.8	00.5	213 30.5	43.4	191 37.3	106	23 03.5	80
18	74 10.1	51 25.4	+14 55.2	55 37.1	+ 7 42.0	29 46.8	+16 00.7	228 33.1	− 7 43.4	206 06.9	104	−23 11.5	78
19	89 12.6	66 26.7	56.0	70 37.8	42.7	44 48.9	00.8	243 35.7	43.3	220 36.3	104	23 19.3	77
20	104 15.1	81 28.1	56.8	85 38.6	43.4	59 50.9	00.9	258 38.3	43.3	235 05.7	102	23 27.0	76
21	119 17.5	96 29.4	57.7	100 39.3	44.2	74 52.9	01.1	273 40.8	43.2	249 34.9	102	23 34.6	75
22	134 20.0	111 30.7	58.5	115 40.1	44.9	89 55.0	01.2	288 43.4	43.2	264 04.1	100	23 42.1	74
23	149 22.5	126 32.0	14 59.3	130 40.8	45.6	104 57.0	01.3	303 46.0	43.1	278 33.1	100	23 49.5	73
7 0	164 24.9	141 33.3	+15 00.1	145 41.6	+ 7 46.3	119 59.1	+16 01.4	318 48.6	− 7 43.1	293 02.1	99	−23 56.8	71
1	179 27.4	156 34.6	00.9	160 42.3	47.1	135 01.1	01.6	333 51.2	43.0	307 31.0	98	24 03.9	71
2	194 29.9	171 36.0	01.7	175 43.0	47.8	150 03.2	01.7	348 53.7	43.0	321 59.8	96	24 11.0	69
3	209 32.3	186 37.3	02.6	190 43.8	48.5	165 05.2	01.8	3 56.3	42.9	336 28.4	96	24 17.9	68
4	224 34.8	201 38.6	03.4	205 44.5	49.2	180 07.3	02.0	18 58.9	42.9	350 57.0	95	24 24.7	67
5	239 37.3	216 40.0	04.2	220 45.3	50.0	195 09.3	02.1	34 01.5	42.8	5 25.5	95	24 31.4	65
6	254 39.7	231 41.3	+15 05.0	235 46.0	+ 7 50.7	210 11.3	+16 02.2	49 04.0	− 7 42.8	19 54.0	93	−24 37.9	65
7	269 42.2	246 42.6	05.8	250 46.8	51.4	225 13.4	02.3	64 06.6	42.7	34 22.3	92	24 44.4	63
8	284 44.6	261 44.0	06.6	265 47.5	52.2	240 15.4	02.5	79 09.2	42.7	48 50.5	91	24 50.7	62
9	299 47.1	276 45.3	07.4	280 48.3	52.9	255 17.5	02.6	94 11.8	42.6	63 18.6	91	24 56.9	61
10	314 49.6	291 46.6	08.2	295 49.0	53.6	270 19.5	02.7	109 14.3	42.6	77 46.7	89	25 03.0	59
11	329 52.0	306 48.0	09.0	310 49.7	54.3	285 21.6	02.9	124 16.9	42.5	92 14.6	89	25 08.9	58
12	344 54.5	321 49.3	+15 09.8	325 50.5	+ 7 55.1	300 23.6	+16 03.0	139 19.5	− 7 42.5	106 42.5	88	−25 14.7	57
13	359 57.0	336 50.7	10.6	340 51.2	55.8	315 25.6	03.1	154 22.1	42.4	121 10.3	87	25 20.4	56
14	14 59.4	351 52.1	11.4	355 52.0	56.5	330 27.7	03.2	169 24.6	42.4	135 38.0	86	25 26.0	54
15	30 01.9	6 53.4	12.2	10 52.7	57.2	345 29.7	03.4	184 27.2	42.3	150 05.6	85	25 31.4	53
16	45 04.4	21 54.8	13.0	25 53.5	58.0	0 31.8	03.5	199 29.8	42.2	164 33.1	84	25 36.7	52
17	60 06.8	36 56.1	13.8	40 54.2	58.7	15 33.8	03.6	214 32.4	42.2	179 00.5	83	25 41.9	50
18	75 09.3	51 57.5	+15 14.6	55 55.0	+ 7 59.4	30 35.8	+16 03.8	229 35.0	− 7 42.1	193 27.8	83	−25 46.9	49
19	90 11.7	66 58.9	15.4	70 55.7	8 00.1	45 37.9	03.9	244 37.5	42.1	207 55.1	81	25 51.8	47
20	105 14.2	82 00.2	16.2	85 56.4	00.9	60 39.9	04.0	259 40.1	42.0	222 22.2	81	25 56.5	46
21	120 16.7	97 01.6	17.0	100 57.2	01.6	75 42.0	04.1	274 42.7	42.0	236 49.3	80	26 01.1	45
22	135 19.1	112 03.0	17.8	115 57.9	02.3	90 44.0	04.3	289 45.3	41.9	251 16.3	79	26 05.6	44
23	150 21.6	127 04.3	18.6	130 58.7	03.0	105 46.0	04.4	304 47.9	41.9	265 43.2	78	26 10.0	41
24	165 24.1	142 05.7	+15 19.4	145 59.4	+ 8 03.7	120 48.1	+16 04.5	319 50.4	− 7 41.8	280 10.0	78	−26 14.1	41
code	−	+ 13	+ 8	+ 8	+ 7	+ 21	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
5 0	177 04.3	− 6 15.0
1	192 04.4	14.0
2	207 04.5	13.1
3	222 04.7	12.1
4	237 04.8	11.1
5	252 05.0	10.2
6	267 05.1	− 6 09.2
7	282 05.2	08.2
8	297 05.4	07.3
9	312 05.5	06.3
10	327 05.7	05.3
11	342 05.8	04.4
12	357 05.9	− 6 03.4
13	12 06.1	02.5
14	27 06.2	01.5
15	42 06.4	− 6 00.5
16	57 06.5	5 59.6
17	72 06.7	58.6
18	87 06.8	− 5 57.6
19	102 06.9	56.7
20	117 07.1	55.7
21	132 07.2	54.7
22	147 07.4	53.8
23	162 07.5	52.8
6 0	177 07.7	− 5 51.8
1	192 07.8	50.9
2	207 08.0	49.9
3	222 08.1	48.9
4	237 08.2	48.0
5	252 08.4	47.0
6	267 08.5	− 5 46.0
7	282 08.7	45.0
8	297 08.8	44.1
9	312 09.0	43.1
10	327 09.1	42.1
11	342 09.3	41.2
12	357 09.4	− 5 40.2
13	12 09.6	39.2
14	27 09.7	38.3
15	42 09.9	37.3
16	57 10.0	36.3
17	72 10.1	35.4
18	87 10.3	− 5 34.4
19	102 10.4	33.4
20	117 10.6	32.4
21	132 10.7	31.5
22	147 10.9	30.5
23	162 11.0	29.5
7 0	177 11.2	− 5 28.6
1	192 11.3	27.6
2	207 11.5	26.6
3	222 11.6	25.7
4	237 11.8	24.7
5	252 11.9	23.7
6	267 12.1	− 5 22.7
7	282 12.2	21.8
8	297 12.4	20.8
9	312 12.5	19.8
10	327 12.7	18.9
11	342 12.8	17.9
12	357 13.0	− 5 16.9
13	12 13.1	15.9
14	27 13.3	15.0
15	42 13.4	14.0
16	57 13.6	13.0
17	72 13.7	12.0
18	87 13.9	− 5 11.1
19	102 14.0	10.1
20	117 14.2	09.1
21	132 14.3	08.2
22	147 14.5	07.2
23	162 14.6	06.2
24	177 14.8	− 5 05.2
code	−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.5	−57 28.6
30	Acrux	173 59.6	−62 50.5
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.6	+56 12.5
34	Alkaid	153 33.9	+49 32.4
55	Al Na'ir	28 40.7	−47 11.3
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.1	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.6	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.7	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.3	−68 56.6
22	Avior	234 36.2	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.1	−52 40.4
12	Capella	281 41.3	+45 57.4
53	Deneb	50 02.8	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.5	−18 14.7
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.3	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.1	−56 51.1
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 51.9	−60 08.9
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.9	−34 24.6
40	Kochab	137 16.8	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.8	−36 08.5
24	Miapl'dus	221 48.9	−69 31.6
9	Mirfak	309 45.5	+49 42.1
50	Nunki	76 54.5	−26 21.5
52	Peacock	54 30.7	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.5	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.4	−60 38.7
44	Sabik	103 04.4	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.4	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.7
49	Vega	81 09.8	+38 44.0
39	Zub'g'bi	137 55.4	−15 51.1

GMT	Equation of Time (App.—Mean) 5	6	7
h	m s	m s	m s
0	−11 43.3	−11 29.6	−11 15.6
6	−11 39.9	−11 26.2	−11 12.0
12	−11 36.5	−11 22.7	−11 08.4
18	−11 33.1	−11 19.1	−11 04.8
24	−11 29.6	−11 15.6	−11 01.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 5 h m	6 h m	7 h m	8 h m
72	7 12	3 19	1 27	■	■	■
70	7 05	3 39	0 35	■	■	■
68	7 00	3 53	0 03	2 35	■	■
66	6 55	4 05	25 40	1 40	■	■
64	6 51	4 13	25 07	1 07	3 09	■
62	6 48	4 22	24 44	0 44	2 26	4 10
60	6 45	4 28	24 25	0 25	1 58	3 27
58	6 42	4 33	24 09	0 09	1 36	2 58
56	6 40	4 38	23 56	25 18	1 18	2 36
54	6 37	4 42	23 44	25 03	1 03	2 18
52	6 35	4 45	23 34	24 50	0 50	2 03
50	6 34	4 48	23 25	24 38	0 38	1 49
45	6 30	4 53	23 06	24 15	0 15	1 22
40	6 26	4 58	22 51	23 56	25 00	1 00
35	6 23	5 01	22 38	23 40	24 43	0 43
30	6 21	5 03	22 27	23 26	24 27	0 27
20	6 16	5 04	22 08	23 03	24 01	0 01
10	6 12	5 03	21 51	22 44	23 39	24 37
0	6 08	4 59	21 36	22 25	23 18	24 15
10	6 04	4 54	21 20	22 07	22 58	23 54
20	6 00	4 45	21 04	21 47	22 36	23 30
30	5 54	4 33	20 46	21 25	22 10	23 04
35	5 51	4 23	20 35	21 11	21 55	22 48
40	5 48	4 13	20 23	20 56	21 38	22 29
45	5 44	3 59	20 08	20 38	21 17	22 07
50	5 39	3 41	19 51	20 16	20 51	21 39
52	5 36	3 33	19 42	20 06	20 39	21 25
54	5 34	3 22	19 33	19 54	20 24	21 09
56	5 31	3 10	19 23	19 40	20 07	20 51
58	5 28	2 56	19 11	19 25	19 47	20 28
60	5 24	2 38	18 58	19 06	19 22	19 58
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 5 h m	6 h m	7 h m	8 h m
72	17 13	21 12	4 13	■	■	■
70	17 20	20 52	5 07	■	■	■
68	17 25	20 36	5 41	4 45	■	■
66	17 29	20 24	6 05	5 41	■	■
64	17 33	20 14	6 25	6 14	5 57	■
62	17 37	20 07	6 40	6 39	6 40	6 48
60	17 39	19 59	6 54	6 59	7 09	7 32
58	17 42	19 54	7 05	7 15	7 32	8 01
56	17 44	19 49	7 15	7 29	7 50	8 24
54	17 46	19 44	7 24	7 41	8 05	8 42
52	17 48	19 41	7 32	7 51	8 19	8 58
50	17 50	19 38	7 39	8 01	8 30	9 11
45	17 54	19 32	7 54	8 21	8 55	9 39
40	17 57	19 27	8 07	8 37	9 15	10 01
35	18 00	19 24	8 18	8 51	9 31	10 19
30	18 02	19 21	8 27	9 03	9 45	10 35
20	18 07	19 20	8 44	9 24	10 10	11 01
10	18 11	19 21	8 58	9 42	10 31	11 24
0	18 15	19 24	9 12	9 59	10 50	11 45
10	18 19	19 29	9 25	10 16	11 10	12 07
20	18 23	19 37	9 40	10 34	11 31	12 29
30	18 28	19 49	9 57	10 55	11 56	12 56
35	18 31	19 57	10 06	11 08	12 10	13 12
40	18 35	20 08	10 18	11 22	12 27	13 30
45	18 39	20 22	10 31	11 39	12 47	13 52
50	18 43	20 38	10 47	12 00	13 12	14 20
52	18 46	20 48	10 55	12 10	13 25	14 33
54	18 48	20 57	11 03	12 22	13 39	14 49
56	18 51	21 09	11 13	12 35	13 55	15 08
58	18 54	21 23	11 24	12 50	14 15	15 31
60	18 57	21 39	11 37	13 08	14 40	16 01
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
5	3 01	14 37	14 19	16 04	2 53
6	3 47	14 35	14 18	16 01	2 48
7	4 38	14 33	14 17	15 58	2 44
8	5 32	14 30	14 15	15 55	2 40

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.3	0.1
30	0.5	0.3	0.1
45	0.5	0.2	0.0
60	0.5	0.1	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	5	6	7
°	′	′	′
0	13.1	13.8	14.7
4	13.1	13.8	14.7
8	13.2	13.8	14.7
12	13.2	13.8	14.7
16	13.2	13.8	14.7
20	13.3	13.9	14.7
24	13.3	13.9	14.7
28	13.4	14.0	14.8
32	13.5	14.0	14.8
36	13.5	14.1	14.8
40	13.6	14.1	14.8
44	13.7	14.2	14.9
48	13.8	14.3	14.9
52	13.9	14.3	14.9
56	14.0	14.4	15.0
60	14.1	14.5	15.0
64	14.3	14.6	15.1
68	14.4	14.7	15.1
72	14.5	14.8	15.2
76	14.6	14.9	15.2
80	14.8	15.0	15.3
84	14.9	15.1	15.3
88	15.0	15.1	15.3
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	5	6	7
°	′	′	′
0	16.9	16.6	16.1
4	16.9	16.6	16.1
8	16.9	16.5	16.0
12	16.9	16.5	16.0
16	16.8	16.5	16.0
20	16.8	16.5	16.0
24	16.7	16.4	16.0
28	16.7	16.4	16.0
32	16.6	16.3	15.9
36	16.5	16.3	15.9
40	16.4	16.2	15.9
44	16.4	16.1	15.8
48	16.3	16.1	15.8
52	16.2	16.0	15.8
56	16.0	15.9	15.7
60	15.9	15.8	15.7
64	15.8	15.7	15.6
68	15.7	15.6	15.6
72	15.6	15.6	15.6
76	15.4	15.5	15.5
80	15.3	15.4	15.5
84	15.2	15.3	15.4
88	15.1	15.2	15.4
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.5 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
8 0	165 24.1	142 05.7	+15 19.4	145 59.4	+ 8 03.7	120 48.1	+16 04.5	319 50.4	− 7 41.8	280 10.0	78	−26 14.1	− 41
1	180 26.5	157 07.1	20.2	161 00.2	04.5	135 50.1	04.7	334 53.0	41.8	294 36.8	76	26 18.2	− 39
2	195 29.0	172 08.5	21.0	176 00.9	05.2	150 52.2	04.8	349 55.6	41.7	309 03.4	76	26 22.1	− 38
3	210 31.5	187 09.9	·· 21.7	191 01.6	·· 05.9	165 54.2	·· 04.9	4 58.2	·· 41.7	323 30.0	75	·26 25.9	− 36
4	225 33.9	202 11.3	22.5	206 02.4	06.6	180 56.2	05.1	20 00.7	41.6	337 56.5	74	26 29.5	− 35
5	240 36.4	217 12.6	23.3	221 03.1	07.4	195 58.3	05.2	35 03.3	41.6	352 22.9	74	26 33.0	− 33
6	255 38.9	232 14.0	+15 24.1	236 03.9	+ 8 08.1	211 00.3	+16 05.3	50 05.9	− 7 41.5	6 49.3	73	−26 36.3	− 32
7	270 41.3	247 15.4	24.9	251 04.6	08.8	226 02.3	05.4	65 08.5	41.5	21 15.6	72	26 39.5	− 30
8	285 43.8	262 16.8	25.7	266 05.4	09.5	241 04.4	05.6	80 11.1	41.4	35 41.8	71	26 42.5	− 29
9	300 46.2	277 18.2	·· 26.4	281 06.1	·· 10.2	256 06.4	·· 05.7	95 13.6	·· 41.4	50 07.9	70	·26 45.4	− 27
10	315 48.7	292 19.6	27.2	296 06.8	11.0	271 08.5	05.8	110 16.2	41.3	64 33.9	70	26 48.1	− 26
11	330 51.2	307 21.0	28.0	311 07.6	11.7	286 10.5	06.0	125 18.8	41.2	78 59.9	69	26 50.7	− 24
12	345 53.6	322 22.4	+15 28.8	326 08.3	+ 8 12.4	301 12.5	+16 06.1	140 21.4	− 7 41.2	93 25.8	69	−26 53.1	− 22
13	0 56.1	337 23.9	29.6	341 09.1	13.1	316 14.6	06.2	155 24.0	41.1	107 51.7	68	26 55.3	− 22
14	15 58.6	352 25.3	30.3	356 09.8	13.9	331 16.6	06.4	170 26.5	41.1	122 17.5	67	26 57.5	− 19
15	31 01.0	7 26.7	·· 31.1	11 10.6	·· 14.6	346 18.6	·· 06.5	185 29.1	·· 41.0	136 43.2	66	·26 59.4	− 18
16	46 03.5	22 28.1	31.9	26 11.3	15.3	1 20.7	06.6	200 31.7	41.0	151 08.8	66	27 01.2	− 16
17	61 06.0	37 29.5	32.6	41 12.1	16.0	16 22.7	06.7	215 34.3	40.9	165 34.4	65	27 02.8	− 15
18	76 08.4	52 30.9	+15 33.4	56 12.8	+ 8 16.7	31 24.8	+16 06.9	230 36.9	− 7 40.9	179 59.9	65	−27 04.3	− 13
19	91 10.9	67 32.4	34.2	71 13.5	17.5	46 26.8	07.0	245 39.5	40.8	194 25.4	64	27 05.6	− 12
20	106 13.4	82 33.8	35.0	86 14.3	18.2	61 28.8	07.1	260 42.0	40.8	208 50.8	63	27 06.8	− 10
21	121 15.8	97 35.2	·· 35.7	101 15.0	·· 18.9	76 30.9	·· 07.3	275 44.6	·· 40.7	223 16.1	63	·27 07.8	− 8
22	136 18.3	112 36.7	36.5	116 15.8	19.6	91 32.9	07.4	290 47.2	40.7	237 41.4	63	27 08.6	− 7
23	151 20.7	127 38.1	37.3	131 16.5	20.3	106 34.9	07.5	305 49.8	40.6	252 06.7	62	27 09.3	− 5
9 0	166 23.2	142 39.5	+15 38.0	146 17.3	+ 8 21.1	121 37.0	+16 07.7	320 52.4	− 7 40.6	266 31.9	61	−27 09.8	− 4
1	181 25.7	157 41.0	38.8	161 18.0	21.8	136 39.0	07.8	335 54.9	40.5	280 57.0	61	27 10.2	− 2
2	196 28.1	172 42.4	39.5	176 18.7	22.5	151 41.0	07.9	350 57.5	40.4	295 22.1	60	27 10.4	0
3	211 30.6	187 43.9	·· 40.3	191 19.5	·· 23.2	166 43.1	·· 08.0	6 00.1	·· 40.4	309 47.1	60	·27 10.4	+ 2
4	226 33.1	202 45.3	41.1	206 20.2	23.9	181 45.1	08.2	21 02.7	40.3	324 12.1	59	27 10.2	+ 3
5	241 35.5	217 46.8	41.8	221 21.0	24.7	196 47.1	08.3	36 05.3	40.3	338 37.0	59	27 09.9	+ 5
6	256 38.0	232 48.2	+15 42.6	236 21.7	+ 8 25.4	211 49.2	+16 08.4	51 07.9	− 7 40.2	353 01.9	59	−27 09.4	+ 6
7	271 40.5	247 49.7	43.3	251 22.4	26.1	226 51.2	08.6	66 10.4	40.2	7 26.8	58	27 08.8	+ 8
8	286 42.9	262 51.1	44.1	266 23.2	26.8	241 53.2	08.7	81 13.0	40.1	21 51.6	58	27 08.0	+ 10
9	301 45.4	277 52.6	·· 44.8	281 23.9	·· 27.5	256 55.3	·· 08.8	96 15.6	·· 40.1	36 16.4	57	·27 07.0	+ 12
10	316 47.9	292 54.1	45.6	296 24.7	28.2	271 57.3	09.0	111 18.2	40.0	50 41.1	57	27 05.8	+ 13
11	331 50.3	307 55.5	46.3	311 25.4	29.0	286 59.3	09.1	126 20.8	40.0	65 05.8	57	27 04.5	+ 15
12	346 52.8	322 57.0	+15 47.1	326 26.2	+ 8 29.7	302 01.4	+16 09.2	141 23.4	− 7 39.9	79 30.5	56	−27 03.0	+ 17
13	1 55.2	337 58.5	47.8	341 26.9	30.4	317 03.4	09.4	156 25.9	39.9	93 55.1	57	27 01.3	+ 18
14	16 57.7	352 59.9	48.6	356 27.6	31.1	332 05.4	09.5	171 28.5	39.8	108 19.8	55	26 59.5	+ 20
15	32 00.2	8 01.4	·· 49.3	11 28.4	·· 31.8	347 07.5	·· 09.6	186 31.1	·· 39.7	122 44.3	56	·26 57.5	+ 22
16	47 02.6	23 02.9	50.1	26 29.1	32.6	2 09.5	09.8	201 33.7	39.7	137 08.9	55	26 55.3	+ 23
17	62 05.1	38 04.4	50.8	41 29.9	33.3	17 11.5	09.9	216 36.3	39.6	151 33.4	55	26 53.0	+ 26
18	77 07.6	53 05.9	+15 51.6	56 30.6	+ 8 34.0	32 13.6	+16 10.0	231 38.9	− 7 39.6	165 57.9	55	−26 50.4	+ 26
19	92 10.0	68 07.3	52.3	71 31.4	34.7	47 15.6	10.1	246 41.4	39.5	180 22.4	55	26 47.8	+ 29
20	107 12.5	83 08.8	53.0	86 32.1	35.4	62 17.6	10.3	261 44.0	39.5	194 46.9	55	26 44.9	+ 31
21	122 15.0	98 10.3	·· 53.8	101 32.8	·· 36.1	77 19.6	·· 10.4	276 46.6	·· 39.4	209 11.4	54	·26 41.8	+ 32
22	137 17.4	113 11.8	54.5	116 33.6	36.9	92 21.7	10.5	291 49.2	39.4	223 35.8	54	26 38.6	+ 34
23	152 19.9	128 13.3	55.3	131 34.3	37.6	107 23.7	10.7	306 51.8	39.3	238 00.2	54	26 35.2	+ 35
10 0	167 22.4	143 14.8	+15 56.0	146 35.1	+ 8 38.3	122 25.7	+16 10.8	321 54.4	− 7 39.3	252 24.6	54	−26 31.7	+ 37
1	182 24.8	158 16.3	56.7	161 35.8	39.0	137 27.8	10.9	336 57.0	39.2	266 49.0	54	26 28.0	+ 39
2	197 27.3	173 17.8	57.5	176 36.6	39.7	152 29.8	11.1	351 59.5	39.1	281 13.4	54	26 24.1	+ 41
3	212 29.7	188 19.3	·· 58.2	191 37.3	·· 40.4	167 31.8	·· 11.2	7 02.1	·· 39.1	295 37.8	54	·26 20.0	+ 43
4	227 32.2	203 20.9	58.9	206 38.0	41.1	182 33.9	11.3	22 04.7	39.0	310 02.2	54	26 15.7	+ 44
5	242 34.7	218 22.4	15 59.7	221 38.8	41.9	197 35.9	11.5	37 07.3	39.0	324 26.6	54	26 11.3	+ 46
6	257 37.1	233 23.9	+16 00.4	236 39.5	+ 8 42.6	212 37.9	+16 11.6	52 09.9	− 7 38.9	338 51.0	53	−26 06.7	+ 48
7	272 39.6	248 25.4	01.1	251 40.3	43.3	227 39.9	11.7	67 12.5	38.9	353 15.3	54	26 01.9	+ 49
8	287 42.1	263 26.9	01.8	266 41.0	44.0	242 42.0	11.9	82 15.1	38.8	7 39.7	54	25 57.0	+ 51
9	302 44.5	278 28.4	·· 02.6	281 41.7	·· 44.7	257 44.0	·· 12.0	97 17.6	·· 38.8	22 04.1	54	·25 51.9	+ 53
10	317 47.0	293 30.0	03.3	296 42.5	45.4	272 46.0	12.1	112 20.2	38.7	36 28.5	54	25 46.6	+ 55
11	332 49.5	308 31.5	04.0	311 43.2	46.1	287 48.1	12.2	127 22.8	38.6	50 52.9	54	25 41.1	+ 56
12	347 51.9	323 33.0	+16 04.7	326 44.0	+ 8 46.9	302 50.1	+16 12.4	142 25.4	− 7 38.6	65 17.3	54	−25 35.5	+ 58
13	2 54.4	338 34.6	05.5	341 44.7	47.6	317 52.1	12.5	157 28.0	38.5	79 41.7	54	25 29.7	+ 60
14	17 56.8	353 36.1	06.2	356 45.5	48.3	332 54.1	12.6	172 30.6	38.5	94 06.1	55	25 23.7	+ 61
15	32 59.3	8 37.7	·· 06.9	11 46.2	·· 49.0	347 56.2	·· 12.8	187 33.2	·· 38.4	108 30.6	54	·25 17.6	+ 63
16	48 01.8	23 39.2	07.6	26 46.9	49.7	2 58.2	12.9	202 35.7	38.4	122 55.0	55	25 11.3	+ 65
17	63 04.2	38 40.7	08.3	41 47.7	50.4	18 00.2	13.0	217 38.3	38.3	137 19.5	55	25 04.8	+ 67
18	78 06.7	53 42.3	+16 09.0	56 48.4	+ 8 51.1	33 02.2	+16 13.2	232 40.9	− 7 38.3	151 44.0	55	−24 58.1	+ 68
19	93 09.2	68 43.8	09.7	71 49.2	51.9	48 04.3	13.3	247 43.5	38.2	166 08.5	55	24 51.3	+ 70
20	108 11.6	83 45.4	10.5	86 49.9	52.6	63 06.3	13.4	262 46.1	38.2	180 33.0	56	24 44.3	+ 72
21	123 14.1	98 47.0	·· 11.2	101 50.6	·· 53.3	78 08.3	·· 13.6	277 48.7	·· 38.1	194 57.6	55	·24 37.1	+ 73
22	138 16.6	113 48.5	11.9	116 51.4	54.0	93 10.3	13.7	292 51.3	38.0	209 22.1	56	24 29.8	+ 75
23	153 19.0	128 50.1	12.6	131 52.1	54.7	108 12.4	13.8	307 53.9	38.0	223 46.7	57	24 22.3	+ 76
24	168 21.5	143 51.6	+16 13.3	146 52.9	+ 8 55.4	123 14.4	+16 14.0	322 56.4	− 7 37.9	238 11.4	56	−24 14.7	+ 79
code	−	+ 15	+ 7	+ 7	+ 7	+ 20	+ 2	+ 25	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
8 0	177 14.8	− 5 05.2
1	192 14.9	04.3
2	207 15.1	03.3
3	222 15.3 ··	02.3
4	237 15.4	01.3
5	252 15.6	5 00.4
6	267 15.7	− 4 59.4
7	282 15.9	58.4
8	297 16.0	57.4
9	312 16.2 ··	56.5
10	327 16.3	55.5
11	342 16.5	54.5
12	357 16.6	− 4 53.5
13	12 16.8	52.6
14	27 16.9	51.6
15	42 17.1 ··	50.6
16	57 17.3	49.6
17	72 17.4	48.7
18	87 17.6	− 4 47.7
19	102 17.7	46.7
20	117 17.9	45.7
21	132 18.0 ··	44.8
22	147 18.2	43.8
23	162 18.3	42.8
9 0	177 18.5	− 4 41.8
1	192 18.7	40.9
2	207 18.8	39.9
3	222 19.0 ··	38.9
4	237 19.1	37.9
5	252 19.3	37.0
6	267 19.4	− 4 36.0
7	282 19.6	35.0
8	297 19.8	34.0
9	312 19.9 ··	33.0
10	327 20.1	32.1
11	342 20.2	31.1
12	357 20.4	− 4 30.1
13	12 20.5	29.1
14	27 20.7	28.2
15	42 20.9 ··	27.2
16	57 21.0	26.2
17	72 21.2	25.2
18	87 21.3	− 4 24.2
19	102 21.5	23.3
20	117 21.7	22.3
21	132 21.8 ··	21.3
22	147 22.0	20.3
23	162 22.1	19.3
10 0	177 22.3	− 4 18.4
1	192 22.5	17.4
2	207 22.6	16.4
3	222 22.8 ··	15.4
4	237 22.9	14.5
5	252 23.1	13.5
6	267 23.3	− 4 12.5
7	282 23.4	11.5
8	297 23.6	10.5
9	312 23.7 ··	09.6
10	327 23.9	08.6
11	342 24.1	07.6
12	357 24.2	− 4 06.6
13	12 24.4	05.6
14	27 24.5	04.7
15	42 24.7 ··	03.7
16	57 24.9	02.7
17	72 25.0	01.7
18	87 25.2	− 4 00.7
19	102 25.4	3 59.8
20	117 25.5	58.8
21	132 25.7 ··	57.8
22	147 25.8	56.8
23	162 26.0	55.8
24	177 26.2	− 3 54.9
code	−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.6	−62 50.5
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.5
34	Alkaid	153 33.9	+49 32.4
55	Al Na'ir	28 40.7	−47 11.3
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.1	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.5	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.7	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.2	−68 56.6
22	Avior	234 36.3	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.1	−52 40.4
12	Capella	281 41.3	+45 57.4
53	Deneb	50 02.8	+45 06.5
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.1
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.2	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.1	−29 52.3
31	Gacrux	172 51.1	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 51.9	−60 08.9
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.9	−34 24.6
40	Kochab	137 16.8	+74 20.4
57	Markab	14 23.8	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.8	−36 08.5
24	Miapl'dus	221 49.0	−69 31.6
9	Mirfak	309 45.5	+49 42.0
50	Nunki	76 54.4	−26 21.5
52	Peacock	54 30.7	−56 53.2
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.4	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.4	−60 38.7
44	Sabik	103 04.4	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.4	−37 04.3
18	Sirius	259 13.4	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.8
49	Vega	81 09.7	+38 44.0
39	Zub'g'bi	137 55.4	−15 51.1

GMT	Equation of Time (App.—Mean) 8	9	10
h	m s	m s	m s
0	−11 01.1	−10 46.3	−10 31.2
6	−10 57.5	−10 42.6	−10 27.3
12	−10 53.8	−10 38.8	−10 23.5
18	−10 50.0	−10 35.0	−10 19.6
24	−10 46.3	−10 31.2	−10 15.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 8 h m	9 h m	10 h m	11 h m
72	6 56	2 59	▬	▬	▬	▬
70	6 51	3 21	▬	▬	▬	▬
68	6 47	3 38	▬	▬	▬	▬
66	6 44	3 51	▬	▬	▬	7 28
64	6 41	4 02	▬	▬	▬	6 35
62	6 38	4 11	4 10	5 30	5 57	6 02
60	6 36	4 19	3 27	4 38	5 19	5 38
58	6 34	4 24	2 58	4 06	4 52	5 18
56	6 32	4 29	2 36	3 42	4 30	5 02
54	6 30	4 35	2 18	3 23	4 13	4 48
52	6 29	4 38	2 03	3 07	3 58	4 36
50	6 27	4 41	1 49	2 53	3 45	4 25
45	6 24	4 48	1 22	2 24	3 18	4 02
40	6 22	4 53	1 00	2 02	2 56	3 44
35	6 19	4 57	0 43	1 43	2 39	3 28
30	6 17	5 00	0 27	1 27	2 23	3 15
20	6 14	5 02	0 01	1 00	1 57	2 52
10	6 11	5 01	24 37	0 37	1 35	2 32
0	6 07	4 59	24 15	0 15	1 14	2 13
10	6 04	4 54	23 54	24 53	0 53	1 54
20	6 00	4 46	23 30	24 31	0 31	1 34
30	5 56	4 35	23 04	24 04	0 04	1 11
35	5 54	4 27	22 48	23 49	24 57	0 57
40	5 51	4 17	22 29	23 31	24 41	0 41
45	5 48	4 04	22 07	23 09	24 22	0 22
50	5 44	3 48	21 39	22 42	23 59	25 24
52	5 42	3 40	21 25	22 28	23 47	25 15
54	5 40	3 31	21 09	22 13	23 34	25 06
56	5 38	3 20	20 51	21 55	23 19	24 55
58	5 35	3 07	20 28	21 33	23 01	24 42
60 S	5 32	2 51	19 58	21 04	22 39	24 27

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 8 h m	9 h m	10 h m	11 h m
72	17 27	21 32	▬	▬	▬	▬
70	17 32	21 08	▬	▬	▬	▬
68	17 36	20 50	▬	▬	▬	▬
66	17 39	20 35	▬	▬	▬	9 39
64	17 42	20 24	▬	▬	▬	10 32
62	17 45	20 16	6 48	7 29	9 06	11 04
60	17 47	20 08	7 32	8 21	9 44	11 28
58	17 49	20 01	8 01	8 52	10 10	11 47
56	17 51	19 56	8 24	9 16	10 31	12 03
54	17 52	19 51	8 42	9 36	10 49	12 16
52	17 54	19 47	8 58	9 52	11 03	12 28
50	17 55	19 43	9 11	10 06	11 16	12 38
45	17 58	19 36	9 39	10 35	11 43	13 00
40	18 00	19 30	10 01	10 57	12 03	13 17
35	18 03	19 27	10 19	11 16	12 21	13 32
30	18 04	19 23	10 35	11 32	12 36	13 44
20	18 08	19 21	11 01	11 58	13 01	14 05
10	18 11	19 21	11 24	12 22	13 22	14 24
0	18 14	19 23	11 45	12 43	13 42	14 41
10	18 17	19 27	12 07	13 05	14 02	14 58
20	18 20	19 34	12 29	13 28	14 24	15 16
30	18 24	19 45	12 56	13 54	14 48	15 37
35	18 27	19 53	13 12	14 10	15 03	15 49
40	18 29	20 02	13 30	14 28	15 19	16 02
45	18 33	20 14	13 52	14 50	15 39	16 19
50	18 36	20 30	14 20	15 18	16 04	16 38
52	18 38	20 38	14 33	15 31	16 15	16 48
54	18 40	20 47	14 49	15 47	16 29	16 58
56	18 42	20 57	15 08	16 05	16 44	17 10
58	18 45	21 10	15 31	16 28	17 03	17 23
60 S	18 47	21 24	16 01	16 57	17 25	17 39

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
8	5 32	14 30	14 15	15 55	2 40
9	6 29	14 28	14 14	15 51	2 36
10	7 28	14 26	14 13	15 48	2 32
11	8 27	14 23	14 12	15 45	2 28

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.4	0.3	0.1
30	0.4	0.3	0.1
45	0.4	0.2	0.0
60	0.4	0.1	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	8 ′	9 ′	10 ′
0	15.6	16.7	17.8
4	15.6	16.7	17.8
8	15.6	16.7	17.8
12	15.6	16.7	17.8
16	15.6	16.7	17.8
20	15.6	16.6	17.7
24	15.6	16.6	17.7
28	15.6	16.6	17.6
32	15.6	16.5	17.5
36	15.6	16.5	17.5
40	15.6	16.5	17.4
44	15.6	16.4	17.3
48	15.6	16.4	17.2
52	15.6	16.3	17.1
56	15.6	16.3	17.0
60	15.6	16.2	16.9
64	15.6	16.2	16.8
68	15.6	16.1	16.7
72	15.6	16.0	16.5
76	15.6	16.0	16.4
80	15.6	15.9	16.3
84	15.6	15.9	16.2
88	15.6	15.8	16.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	8 ′	9 ′	10 ′
0	15.6	14.9	14.2
4	15.6	14.9	14.3
8	15.6	14.9	14.3
12	15.6	14.9	14.3
16	15.6	14.9	14.3
20	15.6	15.0	14.4
24	15.6	15.0	14.4
28	15.6	15.0	14.5
32	15.6	15.0	14.5
36	15.6	15.1	14.6
40	15.6	15.1	14.7
44	15.6	15.2	14.8
48	15.6	15.2	14.9
52	15.6	15.3	15.0
56	15.6	15.3	15.1
60	15.6	15.4	15.2
64	15.6	15.4	15.3
68	15.6	15.5	15.4
72	15.6	15.5	15.5
76	15.6	15.6	15.7
80	15.6	15.7	15.8
84	15.6	15.7	15.9
88	15.6	15.8	16.0
90			

Subtract from table, back cover

Last Quarter 8

918768°—52——4

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
11 0	168 21.5	143 51.6	+16 13.3	146 52.9	+ 8 55.4	123 14.4	+16 14.0	322 56.4	− 7 37.9	238 11.4	56	−24 14.7	+ 79
1	183 24.0	158 53.2	14.0	161 53.6	56.1	138 16.4	14.1	337 59.0	37.9	252 36.0	57	24 06.8	+ 80
2	198 26.4	173 54.8	14.7	176 54.3	56.8	153 18.4	14.2	353 01.6	37.8	267 00.7	57	23 58.8	+ 81
3	213 28.9	188 56.4	·· 15.4	191 55.1	·· 57.6	168 20.5	·· 14.4	8 04.2	·· 37.8	281 25.4	58	·23 50.7	+ 83
4	228 31.3	203 57.9	16.1	206 55.8	58.3	183 22.5	14.5	23 06.8	37.7	295 50.2	57	23 42.4	+ 85
5	243 33.8	218 59.5	16.8	221 56.6	59.0	198 24.5	14.6	38 09.4	37.6	310 14.9	58	23 33.9	+ 87
6	258 36.3	234 01.1	+16 17.5	236 57.3	+ 8 59.7	213 26.5	+16 14.8	53 12.0	− 7 37.6	324 39.7	59	−23 25.2	+ 88
7	273 38.7	249 02.7	18.2	251 58.0	9 00.4	228 28.6	14.9	68 14.6	37.5	339 04.6	59	23 16.4	+ 90
8	288 41.2	264 04.3	18.9	266 58.8	01.1	243 30.6	15.0	83 17.2	37.5	353 29.5	59	23 07.4	+ 91
9	303 43.7	279 05.9	·· 19.6	281 59.5	·· 01.8	258 32.6	·· 15.2	98 19.7	·· 37.4	7 54.4	59	·22 58.3	+ 93
10	318 46.1	294 07.5	20.3	297 00.3	02.5	273 34.6	15.3	113 22.3	37.4	22 19.3	60	22 49.0	+ 94
11	333 48.6	309 09.1	21.0	312 01.0	03.2	288 36.7	15.4	128 24.9	37.3	36 44.3	60	22 39.6	+ 96
12	348 51.1	324 10.7	+16 21.7	327 01.7	+ 9 03.9	303 38.7	+16 15.5	143 27.5	− 7 37.3	51 09.3	61	−22 30.0	+ 98
13	3 53.5	339 12.3	22.4	342 02.5	04.7	318 40.7	15.7	158 30.1	37.2	65 34.4	61	22 20.2	+ 99
14	18 56.0	354 13.9	23.0	357 03.2	05.4	333 42.7	15.8	173 32.7	37.1	79 59.5	62	22 10.3	+101
15	33 58.5	9 15.5	·· 23.7	12 04.0	·· 06.1	348 44.8	·· 15.9	188 35.3	·· 37.1	94 24.7	62	·22 00.2	+102
16	49 00.9	24 17.1	24.4	27 04.7	06.8	3 46.8	16.1	203 37.9	37.0	108 49.9	62	21 50.0	+103
17	64 03.4	39 18.7	25.1	42 05.4	07.5	18 48.8	16.2	218 40.5	37.0	123 15.1	63	21 39.7	+106
18	79 05.8	54 20.3	+16 25.8	57 06.2	+ 9 08.2	33 50.8	+16 16.3	233 43.1	− 7 36.9	137 40.4	64	−21 29.1	+106
19	94 08.3	69 21.9	26.5	72 06.9	08.9	48 52.8	16.5	248 45.6	36.9	152 05.8	63	21 18.5	+109
20	109 10.8	84 23.5	27.2	87 07.7	09.6	63 54.9	16.6	263 48.2	36.8	166 31.1	65	21 07.6	+109
21	124 13.2	99 25.2	·· 27.8	102 08.4	·· 10.3	78 56.9	·· 16.7	278 50.8	·· 36.7	180 56.6	64	·20 56.7	+111
22	139 15.7	114 26.8	28.5	117 09.1	11.0	93 58.9	16.9	293 53.4	36.7	195 22.0	65	20 45.6	+113
23	154 18.2	129 28.4	29.2	132 09.9	11.7	109 00.9	17.0	308 56.0	36.6	209 47.5	66	20 34.3	+114
12 0	169 20.6	144 30.1	+16 29.9	147 10.6	+ 9 12.5	124 02.9	+16 17.1	323 58.6	− 7 36.6	224 13.1	66	−20 22.9	+115
1	184 23.1	159 31.7	30.5	162 11.4	13.2	139 05.0	17.3	339 01.2	36.5	238 38.7	67	20 11.4	+117
2	199 25.6	174 33.3	31.2	177 12.1	13.9	154 07.0	17.4	354 03.8	36.5	253 04.4	67	19 59.7	+118
3	214 28.0	189 35.0	·· 31.9	192 12.8	·· 14.6	169 09.0	·· 17.5	9 06.4	·· 36.4	267 30.1	68	·19 47.9	+120
4	229 30.5	204 36.6	32.6	207 13.6	15.3	184 11.0	17.7	24 09.0	36.4	281 55.9	68	19 35.9	+121
5	244 33.0	219 38.3	33.2	222 14.3	16.0	199 13.0	17.8	39 11.6	36.3	296 21.7	69	19 23.8	+122
6	259 35.4	234 39.9	+16 33.9	237 15.1	+ 9 16.7	214 15.1	+16 17.9	54 14.2	− 7 36.2	310 47.6	69	−19 11.6	+124
7	274 37.9	249 41.6	34.6	252 15.8	17.4	229 17.1	18.1	69 16.7	36.2	325 13.5	70	18 59.2	+125
8	289 40.3	264 43.2	35.2	267 16.5	18.1	244 19.1	18.2	84 19.3	36.1	339 39.5	70	18 46.7	+126
9	304 42.8	279 44.9	·· 35.9	282 17.3	·· 18.8	259 21.1	·· 18.3	99 21.9	·· 36.1	354 05.5	71	·18 34.1	+128
10	319 45.3	294 46.5	36.6	297 18.0	19.5	274 23.1	18.5	114 24.5	36.0	8 31.6	71	18 21.3	+129
11	334 47.7	309 48.2	37.2	312 18.7	20.2	289 25.2	18.6	129 27.1	36.0	22 57.7	72	18 08.4	+130
12	349 50.2	324 49.9	+16 37.9	327 19.5	+ 9 20.9	304 27.2	+16 18.7	144 29.7	− 7 35.9	37 23.9	72	−17 55.4	+131
13	4 52.7	339 51.6	38.5	342 20.2	21.6	319 29.2	18.9	159 32.3	35.8	51 50.1	73	17 42.3	+133
14	19 55.1	354 53.2	39.2	357 21.0	22.3	334 31.2	19.0	174 34.9	35.8	66 16.4	73	17 29.0	+134
15	34 57.6	9 54.9	·· 39.8	12 21.7	·· 23.1	349 33.2	·· 19.1	189 37.5	·· 35.7	80 42.7	74	·17 15.6	+135
16	50 00.1	24 56.6	40.5	27 22.4	23.8	4 35.2	19.3	204 40.1	35.7	95 09.1	74	17 02.1	+136
17	65 02.5	39 58.3	41.2	42 23.2	24.5	19 37.3	19.4	219 42.7	35.6	109 35.5	75	16 48.5	+137
18	80 05.0	55 00.0	+16 41.8	57 23.9	+ 9 25.2	34 39.3	+16 19.5	234 45.3	− 7 35.6	124 02.0	76	−16 34.8	+139
19	95 07.4	70 01.6	42.5	72 24.7	25.9	49 41.3	19.7	249 47.9	35.5	138 28.6	75	16 20.9	+140
20	110 09.9	85 03.3	43.1	87 25.4	26.6	64 43.3	19.8	264 50.5	35.4	152 55.1	77	16 06.9	+141
21	125 12.4	100 05.0	·· 43.8	102 26.1	·· 27.3	79 45.3	·· 19.9	279 53.0	·· 35.4	167 21.8	77	·15 52.8	+141
22	140 14.8	115 06.7	44.4	117 26.9	28.0	94 47.3	20.1	294 55.6	35.3	181 48.5	77	15 38.7	+144
23	155 17.3	130 08.4	45.1	132 27.6	28.7	109 49.4	20.2	309 58.2	35.3	196 15.2	78	15 24.3	+144
13 0	170 19.8	145 10.1	+16 45.7	147 28.4	+ 9 29.4	124 51.4	+16 20.3	325 00.8	− 7 35.2	210 42.0	79	−15 09.9	+145
1	185 22.2	160 11.8	46.3	162 29.1	30.1	139 53.4	20.5	340 03.4	35.1	225 08.9	79	14 55.4	+146
2	200 24.7	175 13.5	47.0	177 29.8	30.8	154 55.4	20.6	355 06.0	35.1	239 35.8	79	14 40.8	+147
3	215 27.2	190 15.3	·· 47.6	192 30.6	·· 31.5	169 57.4	·· 20.7	10 08.6	·· 35.0	254 02.7	80	·14 26.1	+148
4	230 29.6	205 17.0	48.3	207 31.3	32.2	184 59.4	20.9	25 11.2	35.0	268 29.7	80	14 11.3	+150
5	245 32.1	220 18.7	48.9	222 32.0	32.9	200 01.5	21.0	40 13.8	34.9	282 56.7	81	13 56.3	+150
6	260 34.6	235 20.4	+16 49.5	237 32.8	+ 9 33.6	215 03.5	+16 21.1	55 16.4	− 7 34.9	297 23.8	82	−13 41.3	+151
7	275 37.0	250 22.1	50.2	252 33.5	34.3	230 05.5	21.3	70 19.0	34.8	311 51.0	82	13 26.2	+152
8	290 39.5	265 23.9	50.8	267 34.3	35.0	245 07.5	21.4	85 21.6	34.7	326 18.2	82	13 11.0	+153
9	305 41.9	280 25.6	·· 51.4	282 35.0	·· 35.7	260 09.5	·· 21.5	100 24.2	·· 34.7	340 45.4	83	·12 55.7	+154
10	320 44.4	295 27.3	52.1	297 35.7	36.4	275 11.5	21.7	115 26.8	34.6	355 12.7	83	12 40.3	+155
11	335 46.9	310 29.1	52.7	312 36.5	37.1	290 13.5	21.8	130 29.4	34.6	9 40.0	84	12 24.8	+155
12	350 49.3	325 30.8	+16 53.3	327 37.2	+ 9 37.8	305 15.6	+16 21.9	145 32.0	− 7 34.5	24 07.4	84	−12 09.3	+157
13	5 51.8	340 32.5	54.0	342 37.9	38.5	320 17.6	22.1	160 34.6	34.5	38 34.8	85	11 53.6	+157
14	20 54.3	355 34.3	54.6	357 38.7	39.2	335 19.6	22.2	175 37.2	34.4	53 02.3	85	11 37.9	+158
15	35 56.7	10 36.0	·· 55.2	12 39.4	·· 39.9	350 21.6	·· 22.3	190 39.8	·· 34.3	67 29.8	85	·11 22.1	+159
16	50 59.2	25 37.8	55.8	27 40.2	40.6	5 23.6	22.5	205 42.3	34.3	81 57.3	86	11 06.2	+160
17	66 01.7	40 39.5	56.4	42 40.9	41.3	20 25.6	22.6	220 44.9	34.2	96 24.9	86	10 50.2	+160
18	81 04.1	55 41.3	+16 57.1	57 41.6	+ 9 42.0	35 27.6	+16 22.7	235 47.5	− 7 34.2	110 52.5	87	−10 34.2	+161
19	96 06.6	70 43.1	57.7	72 42.4	42.7	50 29.6	22.9	250 50.1	34.1	125 20.2	87	10 18.1	+162
20	111 09.0	85 44.8	58.3	87 43.1	43.4	65 31.7	23.0	265 52.7	34.0	139 47.9	88	10 01.9	+162
21	126 11.5	100 46.6	·· 58.9	102 43.8	·· 44.1	80 33.7	·· 23.1	280 55.3	·· 34.0	154 15.7	87	· 9 45.7	+164
22	141 14.0	115 48.4	16 59.5	117 44.6	44.8	95 35.7	23.3	295 57.9	33.9	168 43.4	89	9 29.3	+163
23	156 16.4	130 50.1	17 00.1	132 45.3	45.5	110 37.7	23.4	311 00.5	33.9	183 11.3	88	9 13.0	+165
24	171 18.9	145 51.9	+17 00.8	147 46.1	+ 9 46.2	125 39.7	+16 23.6	326 03.1	− 7 33.8	197 39.1	89	− 8 56.5	+165
code	−	+ 17	+ 6	+ 7	+ 7	+ 20	+ 2	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
11 h 0	177 26.2	− 3 54.9
1	192 26.3	53.9
2	207 26.5	52.9
3	222 26.7	51.9
4	237 26.8	50.9
5	252 27.0	49.9
6	267 27.1	− 3 49.0
7	282 27.3	48.0
8	297 27.5	47.0
9	312 27.6	46.0
10	327 27.8	45.0
11	342 28.0	44.1
12	357 28.1	− 3 43.1
13	12 28.3	42.1
14	27 28.5	41.1
15	42 28.6	40.1
16	57 28.8	39.1
17	72 29.0	38.2
18	87 29.1	− 3 37.2
19	102 29.3	36.2
20	117 29.5	35.2
21	132 29.6	34.2
22	147 29.8	33.2
23	162 29.9	32.3
12 0	177 30.1	− 3 31.3
1	192 30.3	30.3
2	207 30.4	29.3
3	222 30.6	28.3
4	237 30.8	27.4
5	252 30.9	26.4
6	267 31.1	− 3 25.4
7	282 31.3	24.4
8	297 31.4	23.4
9	312 31.6	22.4
10	327 31.8	21.4
11	342 31.9	20.5
12	357 32.1	− 3 19.5
13	12 32.3	18.5
14	27 32.5	17.5
15	42 32.6	16.5
16	57 32.8	15.5
17	72 33.0	14.6
18	87 33.1	− 3 13.6
19	102 33.3	12.6
20	117 33.5	11.6
21	132 33.6	10.6
22	147 33.8	09.6
23	162 34.0	08.7
13 0	177 34.1	− 3 07.7
1	192 34.3	06.7
2	207 34.5	05.7
3	222 34.6	04.7
4	237 34.8	03.7
5	252 35.0	02.7
6	267 35.2	− 3 01.8
7	282 35.3	3 00.8
8	297 35.5	2 59.8
9	312 35.7	58.8
10	327 35.8	57.8
11	342 36.0	56.8
12	357 36.2	− 2 55.9
13	12 36.3	54.9
14	27 36.5	53.9
15	42 36.7	52.9
16	57 36.9	51.9
17	72 37.0	50.9
18	87 37.2	− 2 49.9
19	102 37.4	49.0
20	117 37.5	48.0
21	132 37.7	47.0
22	147 37.9	46.0
23	162 38.1	45.0
24	177 38.2	− 2 44.0
code	−	+ 10

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.7	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.6	−62 50.5
19	Adhara	255 47.9	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.5
34	Alkaid	153 33.9	+49 32.4
55	Al Na'ir	28 40.7	−47 11.3
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.1	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.5	+ 8 44.4
2	Ankaa	354 00.5	−42 33.7
42	Antares	113 21.7	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.2	−68 56.6
22	Avior	234 36.3	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.1	−52 40.4
12	Capella	281 41.3	+45 57.4
53	Deneb	50 02.7	+45 06.5
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.2	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.3
31	Gacrux	172 51.1	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 51.9	−60 08.9
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.8	−34 24.6
40	Kochab	137 16.7	+74 20.4
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.0	−69 31.6
9	Mirfak	309 45.5	+49 42.0
50	Nunki	76 54.4	−26 21.5
52	Peacock	54 30.6	−56 53.1
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.8	+ 5 20.7
46	R'alhague	96 48.4	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.4	−60 38.7
44	Sabik	103 04.4	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.3	−37 04.3
18	Sirius	259 13.5	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.8
49	Vega	81 09.7	+38 44.0
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 11	12	13
h	m s	m s	m s
0	−10 15.7	− 9 59.9	− 9 43.8
6	−10 11.8	− 9 55.9	− 9 39.7
12	−10 07.8	− 9 51.9	− 9 35.6
18	−10 03.9	− 9 47.8	− 9 31.5
24	− 9 59.9	− 9 43.8	− 9 27.4

Lat.	Sunrise	Twlt. begins	Moonrise 11	12	13	14
N	h m	h m	h m	h m	h m	h m
72	6 41	2 35	■	■	7 24	6 36
70	6 37	3 03	■	8 03	6 59	6 26
68	6 35	3 23	■	7 16	6 40	6 18
66	6 32	3 38	7 28	6 44	6 25	6 11
64	6 30	3 51	6 35	6 21	6 12	6 05
62	6 28	4 00	6 02	6 02	6 01	5 59
60	6 27	4 09	5 38	5 47	5 52	5 55
58	6 25	4 15	5 18	5 34	5 44	5 51
56	6 24	4 22	5 02	5 22	5 36	5 47
54	6 23	4 26	4 48	5 12	5 30	5 44
52	6 22	4 31	4 36	5 03	5 24	5 41
50	6 21	4 35	4 25	4 55	5 19	5 38
45	6 19	4 43	4 02	4 38	5 07	5 32
40	6 17	4 49	3 44	4 23	4 57	5 27
35	6 15	4 53	3 28	4 11	4 49	5 23
30	6 14	4 55	3 15	4 01	4 42	5 19
20	6 11	4 59	2 52	3 42	4 29	5 12
10	6 09	5 00	2 32	3 26	4 18	5 06
0	6 07	4 58	2 13	3 11	4 07	5 01
10	6 04	4 54	1 54	2 56	3 56	4 55
20	6 01	4 47	1 34	2 40	3 45	4 49
30	5 58	4 38	1 11	2 21	3 32	4 43
35	5 56	4 29	0 57	2 10	3 24	4 39
40	5 54	4 21	0 41	1 57	3 16	4 34
45	5 52	4 09	0 22	1 43	3 05	4 29
50	5 48	3 54	25 24	1 24	2 53	4 23
52	5 47	3 46	25 15	1 15	2 47	4 20
54	5 45	3 39	25 06	1 06	2 41	4 17
56	5 44	3 28	24 55	0 55	2 34	4 13
58	5 42	3 17	24 42	0 42	2 26	4 09
60	5 40	3 02	24 27	0 27	2 16	4 05
S						

Lat.	Sunset	Twlt. ends	Moonset 11	12	13	14
N	h m	h m	h m	h m	h m	h m
72	17 41	21 56	■	■	13 46	16 28
70	17 44	21 26	■	11 08	14 08	16 35
68	17 47	21 05	■	11 54	14 25	16 41
66	17 49	20 48	9 39	12 24	14 39	16 45
64	17 51	20 35	10 32	12 46	14 50	16 49
62	17 53	20 25	11 04	13 03	14 59	16 52
60	17 54	20 16	11 28	13 18	15 07	16 55
58	17 56	20 09	11 47	13 30	15 14	16 57
56	17 57	20 03	12 03	13 41	15 21	16 59
54	17 58	19 57	12 16	13 50	15 26	17 01
52	17 59	19 52	12 28	13 58	15 31	17 03
50	18 00	19 48	12 38	14 06	15 35	17 05
45	18 02	19 40	13 00	14 22	15 45	17 08
40	18 04	19 34	13 17	14 34	15 53	17 11
35	18 05	19 29	13 32	14 45	16 00	17 14
30	18 06	19 26	13 44	14 55	16 06	17 16
20	18 09	19 22	14 05	15 11	16 16	17 19
10	18 11	19 21	14 24	15 25	16 25	17 23
0	18 13	19 22	14 41	15 38	16 33	17 26
10	18 15	19 25	14 58	15 51	16 41	17 29
20	18 18	19 32	15 16	16 04	16 49	17 32
30	18 21	19 41	15 37	16 20	16 59	17 35
35	18 23	19 48	15 49	16 29	17 04	17 37
40	18 25	19 57	16 02	16 39	17 11	17 39
45	18 27	20 08	16 19	16 51	17 18	17 42
50	18 30	20 22	16 38	17 05	17 26	17 45
52	18 32	20 30	16 48	17 11	17 30	17 46
54	18 33	20 38	16 58	17 19	17 34	17 48
56	18 35	20 48	17 10	17 27	17 39	17 49
58	18 36	20 58	17 23	17 36	17 44	17 51
60	18 39	21 13	17 39	17 46	17 50	17 53
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
11	8 27	14 23	14 12	15 45	2 28
12	9 25	14 20	14 11	15 42	2 24
13	10 20	14 18	14 09	15 39	2 20
14	11 13	14 15	14 08	15 35	2 15

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.3	0.1
30	0.4	0.3	0.1
45	0.4	0.2	0.0
60	0.4	0.1	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	11	12	13
°	′	′	′
0	19.0	19.9	20.6
4	19.0	19.9	20.6
8	18.9	19.8	20.6
12	18.9	19.8	20.5
16	18.9	19.7	20.4
20	18.8	19.6	20.4
24	18.7	19.5	20.2
28	18.6	19.4	20.1
32	18.5	19.3	20.0
36	18.4	19.2	19.8
40	18.3	19.0	19.6
44	18.2	18.8	19.4
48	18.0	18.7	19.2
52	17.9	18.5	19.0
56	17.7	18.3	18.8
60	17.6	18.1	18.5
64	17.4	17.9	18.3
68	17.2	17.6	18.0
72	17.0	17.4	17.7
76	16.8	17.2	17.5
80	16.7	17.0	17.2
84	16.5	16.7	16.9
88	16.3	16.5	16.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	11	12	13
°	′	′	′
0	13.6	13.1	12.6
4	13.6	13.1	12.7
8	13.6	13.1	12.7
12	13.7	13.2	12.8
16	13.7	13.2	12.8
20	13.8	13.3	12.9
24	13.9	13.4	13.0
28	13.9	13.5	13.2
32	14.0	13.7	13.3
36	14.2	13.8	13.5
40	14.3	13.9	13.7
44	14.4	14.1	13.9
48	14.5	14.3	14.1
52	14.7	14.5	14.3
56	14.9	14.7	14.5
60	15.0	14.9	14.8
64	15.2	15.1	15.0
68	15.4	15.3	15.3
72	15.5	15.5	15.5
76	15.7	15.8	15.8
80	15.9	16.0	16.1
84	16.1	16.2	16.4
88	16.2	16.4	16.6
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
14 0	171 18.9	145 51.9	+17 00.8	147 46.1	+ 9 46.2	125 39.7	+16 23.6	326 03.1	− 7 33.8	197 39.1	89	− 8 56.5	+165
1	186 21.4	160 53.7	01.4	162 46.8	46.9	140 41.7	23.7	341 05.7	33.8	212 07.0	90	8 40.0	+165
2	201 23.8	175 55.5	02.0	177 47.5	47.6	155 43.7	23.8	356 08.3	33.7	226 35.0	89	8 23.5	+167
3	216 26.3	190 57.2	•• 02.6	192 48.3	•• 48.3	170 45.7	•• 24.0	11 10.9	•• 33.6	241 02.9	90	• 8 06.8	+166
4	231 28.8	205 59.0	03.2	207 49.0	49.0	185 47.8	24.1	26 13.5	33.6	255 30.9	91	7 50.2	+168
5	246 31.2	221 00.8	03.8	222 49.7	49.7	200 49.8	24.2	41 16.1	33.5	269 59.0	90	7 33.4	+167
6	261 33.7	236 02.6	+17 04.4	237 50.5	+ 9 50.4	215 51.8	+16 24.4	56 18.7	− 7 33.5	284 27.0	91	− 7 16.7	+169
7	276 36.2	251 04.4	05.0	252 51.2	51.1	230 53.8	24.5	71 21.3	33.4	298 55.1	92	6 59.8	+168
8	291 38.6	266 06.2	05.6	267 51.9	51.8	245 55.8	24.6	86 23.9	33.3	313 23.3	91	6 43.0	+170
9	306 41.1	281 08.0	•• 06.2	282 52.7	•• 52.5	260 57.8	•• 24.8	101 26.5	•• 33.3	327 51.4	92	• 6 26.0	+169
10	321 43.5	296 09.8	06.8	297 53.4	53.2	275 59.8	24.9	116 29.1	33.2	342 19.6	92	6 09.1	+170
11	336 46.0	311 11.6	07.4	312 54.2	53.9	291 01.8	25.0	131 31.7	33.2	356 47.8	92	5 52.1	+171
12	351 48.5	326 13.5	+17 08.0	327 54.9	+ 9 54.6	306 03.8	+16 25.2	146 34.3	− 7 33.1	11 16.0	93	− 5 35.0	+170
13	6 50.9	341 15.3	08.6	342 55.6	55.3	321 05.8	25.3	161 36.9	33.0	25 44.3	93	5 18.0	+172
14	21 53.4	356 17.1	09.2	357 56.4	56.0	336 07.8	25.4	176 39.5	33.0	40 12.6	93	5 00.8	+171
15	36 55.9	11 18.9	•• 09.8	12 57.1	•• 56.7	351 09.9	•• 25.6	191 42.1	•• 32.9	54 40.9	93	• 4 43.7	+172
16	51 58.3	26 20.7	10.3	27 57.8	57.4	6 11.9	25.7	206 44.7	32.9	69 09.2	94	4 26.5	+172
17	67 00.8	41 22.6	10.9	42 58.6	58.1	21 13.9	25.8	221 47.3	32.8	83 37.6	93	4 09.3	+172
18	82 03.3	56 24.4	+17 11.5	57 59.3	+ 9 58.8	36 15.9	+16 26.0	236 49.9	− 7 32.7	98 05.9	94	− 3 52.1	+173
19	97 05.7	71 26.2	12.1	73 00.0	9 59.5	51 17.9	26.1	251 52.5	32.7	112 34.3	94	3 34.8	+172
20	112 08.2	86 28.1	12.7	88 00.8	10 00.2	66 19.9	26.2	266 55.1	32.6	127 02.7	95	3 17.6	+173
21	127 10.7	101 29.9	•• 13.3	103 01.5	•• 00.9	81 21.9	•• 26.4	281 57.7	•• 32.6	141 31.2	94	• 3 00.3	+174
22	142 13.1	116 31.8	13.8	118 02.3	01.6	96 23.9	26.5	297 00.3	32.5	155 59.6	95	2 42.9	+173
23	157 15.6	131 33.6	14.4	133 03.0	02.3	111 25.9	26.6	312 02.9	32.4	170 28.1	94	2 25.6	+173
15 0	172 18.0	146 35.5	+17 15.0	148 03.7	+10 03.0	126 27.9	+16 26.8	327 05.5	− 7 32.4	184 56.5	95	− 2 08.3	+174
1	187 20.5	161 37.3	15.6	163 04.5	03.7	141 29.9	26.9	342 08.1	32.3	199 25.0	95	1 50.9	+174
2	202 23.0	176 39.2	16.1	178 05.2	04.4	156 31.9	27.0	357 10.7	32.3	213 53.5	95	1 33.5	+173
3	217 25.4	191 41.0	•• 16.7	193 05.9	•• 05.1	171 33.9	•• 27.2	12 13.3	•• 32.2	228 22.0	96	• 1 16.2	+174
4	232 27.9	206 42.9	17.3	208 06.7	05.7	186 36.0	27.3	27 15.9	32.2	242 50.6	95	0 58.8	+174
5	247 30.4	221 44.8	17.9	223 07.4	06.4	201 38.0	27.5	42 18.5	32.1	257 19.1	95	0 41.4	+174
6	262 32.8	236 46.6	+17 18.4	238 08.1	+10 07.1	216 40.0	+16 27.6	57 21.1	− 7 32.0	271 47.6	96	− 0 24.0	+174
7	277 35.3	251 48.5	19.0	253 08.9	07.8	231 42.0	27.7	72 23.7	32.0	286 16.2	95	− 0 06.6	+174
8	292 37.8	266 50.4	19.6	268 09.6	08.5	246 44.0	27.9	87 26.3	31.9	300 44.7	96	+ 0 10.8	+173
9	307 40.2	281 52.3	•• 20.1	283 10.3	•• 09.2	261 46.0	•• 28.0	102 28.9	•• 31.9	315 13.3	95	• 0 28.1	+174
10	322 42.7	296 54.1	20.7	298 11.1	09.9	276 48.0	28.1	117 31.5	31.8	329 41.8	96	0 45.5	+174
11	337 45.1	311 56.0	21.2	313 11.8	10.6	291 50.0	28.3	132 34.1	31.7	344 10.4	95	1 02.9	+173
12	352 47.6	326 57.9	+17 21.8	328 12.5	+10 11.3	306 52.0	+16 28.4	147 36.7	− 7 31.7	358 38.9	96	+ 1 20.2	+174
13	7 50.1	341 59.8	22.4	343 13.3	12.0	321 54.0	28.5	162 39.3	31.6	13 07.5	96	1 37.6	+173
14	22 52.5	357 01.7	22.9	358 14.0	12.7	336 56.0	28.7	177 41.9	31.6	27 36.1	95	1 54.9	+173
15	37 55.0	12 03.6	•• 23.5	13 14.8	•• 13.4	351 58.0	•• 28.8	192 44.5	•• 31.5	42 04.6	96	• 2 12.2	+173
16	52 57.5	27 05.5	24.0	28 15.5	14.1	7 00.0	28.9	207 47.1	31.4	56 33.2	95	2 29.5	+173
17	67 59.9	42 07.4	24.6	43 16.2	14.8	22 02.0	29.1	222 49.7	31.4	71 01.7	96	2 46.8	+172
18	83 02.4	57 09.3	+17 25.1	58 17.0	+10 15.4	37 04.0	+16 29.2	237 52.3	− 7 31.3	85 30.3	95	+ 3 04.0	+172
19	98 04.9	72 11.2	25.7	73 17.7	16.1	52 06.0	29.3	252 54.9	31.3	99 58.8	96	3 21.2	+172
20	113 07.3	87 13.2	26.2	88 18.4	16.8	67 08.0	29.5	267 57.5	31.2	114 27.4	95	3 38.4	+172
21	128 09.8	102 15.1	•• 26.8	103 19.2	•• 17.5	82 10.0	•• 29.6	283 00.1	•• 31.1	128 55.9	95	• 3 55.6	+171
22	143 12.3	117 17.0	27.3	118 19.9	18.2	97 12.0	29.8	298 02.7	31.1	143 24.4	95	4 12.7	+171
23	158 14.7	132 18.9	27.9	133 20.6	18.9	112 14.0	29.9	313 05.3	31.0	157 52.9	95	4 29.8	+171
16 0	173 17.2	147 20.8	+17 28.4	148 21.4	+10 19.6	127 16.0	+16 30.0	328 07.9	− 7 31.0	172 21.4	95	+ 4 46.9	+170
1	188 19.6	162 22.8	28.9	163 22.1	20.3	142 18.0	30.2	343 10.5	30.9	186 49.9	95	5 03.9	+170
2	203 22.1	177 24.7	29.5	178 22.8	21.0	157 20.0	30.3	358 13.1	30.8	201 18.4	95	5 20.9	+170
3	218 24.6	192 26.7	•• 30.0	193 23.6	•• 21.7	172 22.1	•• 30.4	13 15.7	•• 30.8	215 46.9	94	• 5 37.9	+169
4	233 27.0	207 28.6	30.5	208 24.3	22.4	187 24.1	30.6	28 18.3	30.7	230 15.3	94	5 54.8	+169
5	248 29.5	222 30.5	31.1	223 25.0	23.0	202 26.1	30.7	43 20.9	30.6	244 43.7	95	6 11.7	+168
6	263 32.0	237 32.5	+17 31.6	238 25.8	+10 23.7	217 28.1	+16 30.8	58 23.5	− 7 30.6	259 12.2	94	+ 6 28.5	+168
7	278 34.4	252 34.4	32.1	253 26.5	24.4	232 30.1	31.0	73 26.1	30.5	273 40.6	93	6 45.3	+167
8	293 36.9	267 36.4	32.7	268 27.2	25.1	247 32.1	31.1	88 28.7	30.5	288 08.9	94	7 02.0	+166
9	308 39.4	282 38.4	•• 33.2	283 28.0	•• 25.8	262 34.1	•• 31.2	103 31.3	•• 30.4	302 37.3	94	• 7 18.6	+167
10	323 41.8	297 40.3	33.7	298 28.7	26.5	277 36.1	31.4	118 33.9	30.3	317 05.7	93	7 35.3	+165
11	338 44.3	312 42.3	34.2	313 29.4	27.2	292 38.1	31.5	133 36.5	30.3	331 34.0	93	7 51.8	+165
12	353 46.7	327 44.3	+17 34.8	328 30.2	+10 27.9	307 40.1	+16 31.7	148 39.1	− 7 30.2	346 02.3	93	+ 8 08.3	+165
13	8 49.2	342 46.2	35.3	343 30.9	28.6	322 42.1	31.8	163 41.8	30.2	0 30.6	92	8 24.8	+163
14	23 51.7	357 48.2	35.8	358 31.6	29.2	337 44.1	31.9	178 44.4	30.1	14 58.8	93	8 41.1	+164
15	38 54.1	12 50.2	•• 36.3	13 32.4	•• 29.9	352 46.1	•• 32.1	193 47.0	•• 30.0	29 27.1	92	• 8 57.5	+162
16	53 56.6	27 52.2	36.8	28 33.1	30.6	7 48.1	32.2	208 49.6	30.0	43 55.3	92	9 13.7	+162
17	68 59.1	42 54.2	37.3	43 33.8	31.3	22 50.1	32.3	223 52.2	29.9	58 23.5	91	9 29.9	+161
18	84 01.5	57 56.1	+17 37.9	58 34.6	+10 32.0	37 52.1	+16 32.5	238 54.8	− 7 29.9	72 51.6	91	+ 9 46.0	+160
19	99 04.0	72 58.1	38.4	73 35.3	32.7	52 54.1	32.6	253 57.4	29.8	87 19.7	91	10 02.0	+160
20	114 06.5	88 00.1	38.9	88 36.0	33.4	67 56.1	32.7	269 00.0	29.7	101 47.8	91	10 18.0	+159
21	129 08.9	103 02.1	•• 39.4	103 36.8	•• 34.1	82 58.1	•• 32.9	284 02.6	•• 29.7	116 15.9	91	• 10 33.9	+158
22	144 11.4	118 04.1	39.9	118 37.5	34.7	98 00.1	33.0	299 05.2	29.6	130 44.0	90	10 49.7	+158
23	159 13.9	133 06.1	40.4	133 38.2	35.4	113 02.1	33.1	314 07.8	29.6	145 12.0	90	11 05.5	+156
24	174 16.3	148 08.1	+17 40.9	148 39.0	+10 36.1	128 04.1	+16 33.3	329 10.4	− 7 29.5	159 40.0	89	+11 21.1	+156
code	−	+ 19	+ 6	+ 8	+ 7	+ 20	+ 1	+ 26	+ 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
14	0	177 38.2	− 2 44.0
	1	192 38.4	43.0
	2	207 38.6	42.1
	3	222 38.7	41.1
	4	237 38.9	40.1
	5	252 39.1	39.1
	6	267 39.3	− 2 38.1
	7	282 39.4	37.1
	8	297 39.6	36.1
	9	312 39.8	35.1
	10	327 40.0	34.2
	11	342 40.1	33.2
	12	357 40.3	− 2 32.2
	13	12 40.5	31.2
	14	27 40.6	30.2
	15	42 40.8	29.2
	16	57 41.0	28.2
	17	72 41.2	27.3
	18	87 41.3	− 2 26.3
	19	102 41.5	25.3
	20	117 41.7	24.3
	21	132 41.9	23.3
	22	147 42.0	22.3
	23	162 42.2	21.3
15	0	177 42.4	− 2 20.3
	1	192 42.6	19.4
	2	207 42.7	18.4
	3	222 42.9	17.4
	4	237 43.1	16.4
	5	252 43.3	15.4
	6	267 43.4	− 2 14.4
	7	282 43.6	13.4
	8	297 43.8	12.4
	9	312 44.0	11.5
	10	327 44.1	10.5
	11	342 44.3	09.5
	12	357 44.5	− 2 08.5
	13	12 44.7	07.5
	14	27 44.8	06.5
	15	42 45.0	05.5
	16	57 45.2	04.5
	17	72 45.4	03.6
	18	87 45.5	− 2 02.6
	19	102 45.7	01.6
	20	117 45.9	2 00.6
	21	132 46.1	− 1 59.6
	22	147 46.2	58.6
	23	162 46.4	57.6
16	0	177 46.6	− 1 56.6
	1	192 46.8	55.7
	2	207 47.0	54.7
	3	222 47.1	53.7
	4	237 47.3	52.7
	5	252 47.5	51.7
	6	267 47.7	− 1 50.7
	7	282 47.8	49.7
	8	297 48.0	48.7
	9	312 48.2	47.8
	10	327 48.4	46.8
	11	342 48.6	45.8
	12	357 48.7	− 1 44.8
	13	12 48.9	43.8
	14	27 49.1	42.8
	15	42 49.3	41.8
	16	57 49.4	40.8
	17	72 49.6	39.8
	18	87 49.8	− 1 38.9
	19	102 50.0	37.9
	20	117 50.2	36.9
	21	132 50.3	35.9
	22	147 50.5	34.9
	23	162 50.7	33.9
	24	177 50.9	− 1 32.9
	code	−	+ 10

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.8	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.6	−62 50.5
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.5
34	Alkaid	153 33.9	+49 32.4
55	Al Na'ir	28 40.7	−47 11.3
15	Alnilam	276 32.2	− 1 13.8
25	Alphard	218 40.2	− 8 27.4
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.5	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.7	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 04.1	−68 56.6
22	Avior	234 36.3	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.1	−52 40.4
12	Capella	281 41.4	+45 57.4
53	Deneb	50 02.7	+45 06.5
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.2	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.3
31	Gacrux	172 51.0	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 51.9	−60 08.9
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.8	−34 24.6
40	Kochab	137 16.7	+74 20.4
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.0	−69 31.7
9	Mirfak	309 45.5	+49 42.0
50	Nunki	76 54.4	−26 21.5
52	Peacock	54 30.6	−56 53.1
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.4	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.4	−60 38.7
44	Sabik	103 04.4	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.3	−37 04.3
18	Sirius	259 13.5	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.8
49	Vega	81 09.7	+38 44.0
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 14	15	16
h	m s	m s	m s
0	− 9 27.4	− 9 10.8	− 8 53.9
6	− 9 23.3	− 9 06.6	− 8 49.7
12	− 9 19.1	− 9 02.4	− 8 45.4
18	− 9 15.0	− 8 58.2	− 8 41.2
24	− 9 10.8	− 8 53.9	− 8 36.9

Lat.	Sunrise	Twlt. begins	Moonrise 14	15	16	17
N °	h m	h m	h m	h m	h m	h m
72	6 25	2 07	6 36	6 00	5 25	4 41
70	6 24	2 42	6 26	5 59	5 33	5 02
68	6 22	3 05	6 18	5 59	5 40	5 19
66	6 21	3 24	6 11	5 58	5 46	5 33
64	6 20	3 37	6 05	5 58	5 51	5 44
62	6 19	3 49	5 59	5 57	5 55	5 54
60	6 18	3 58	5 55	5 57	5 59	6 02
58	6 17	4 06	5 51	5 57	6 03	6 10
56	6 16	4 13	5 47	5 57	6 06	6 16
54	6 16	4 18	5 44	5 56	6 09	6 22
52	6 15	4 23	5 41	5 56	6 11	6 28
50	6 14	4 28	5 38	5 56	6 13	6 32
45	6 13	4 37	5 32	5 56	6 19	6 43
40	6 12	4 44	5 27	5 55	6 23	6 52
35	6 11	4 49	5 23	5 55	6 26	7 00
30	6 10	4 52	5 19	5 55	6 30	7 06
20	6 09	4 57	5 12	5 54	6 36	7 18
10	6 07	4 58	5 06	5 54	6 41	7 29
0	6 06	4 57	5 01	5 53	6 46	7 38
10	6 04	4 54	4 55	5 53	6 50	7 48
20	6 02	4 49	4 49	5 53	6 56	7 59
30	6 00	4 40	4 43	5 52	7 02	8 11
35	5 59	4 33	4 39	5 52	7 06	8 19
40	5 57	4 24	4 34	5 52	7 10	8 27
45	5 55	4 14	4 29	5 52	7 14	8 37
50	5 53	4 00	4 23	5 52	7 20	8 48
52	5 52	3 54	4 20	5 51	7 23	8 54
54	5 51	3 45	4 17	5 51	7 26	9 00
56	5 50	3 37	4 13	5 51	7 29	9 07
58	5 48	3 26	4 09	5 51	7 33	9 14
60	5 47	3 13	4 05	5 51	7 37	9 23
S						

Lat.	Sunset	Twlt. ends	Moonset 14	15	16	17
N °	h m	h m	h m	h m	h m	h m
72	17 55	22 24	16 28	18 59	21 36	25 07
70	17 57	21 46	16 35	18 55	21 18	24 02
68	17 58	21 20	16 41	18 51	21 03	23 26
66	17 59	21 01	16 45	18 48	20 51	23 02
64	18 00	20 47	16 49	18 45	20 42	22 42
62	18 01	20 35	16 52	18 43	20 34	22 27
60	18 02	20 25	16 55	18 41	20 27	22 14
58	18 02	20 16	16 57	18 39	20 20	22 02
56	18 03	20 09	16 59	18 37	20 15	21 53
54	18 04	20 04	17 01	18 36	20 10	21 44
52	18 04	19 58	17 03	18 35	20 06	21 37
50	18 05	19 54	17 05	18 34	20 02	21 30
45	18 06	19 44	17 08	18 31	19 53	21 15
40	18 07	19 37	17 11	18 29	19 46	21 03
35	18 07	19 31	17 14	18 27	19 40	20 53
30	18 08	19 28	17 16	18 25	19 35	20 45
20	18 10	19 23	17 19	18 23	19 26	20 29
10	18 11	19 21	17 23	18 20	19 18	20 16
0	18 12	19 21	17 26	18 18	19 10	20 04
10	18 14	19 24	17 29	18 16	19 03	19 52
20	18 15	19 28	17 32	18 13	18 55	19 39
30	18 18	19 38	17 35	18 10	18 46	19 24
35	18 19	19 44	17 37	18 09	18 41	19 15
40	18 20	19 52	17 39	18 07	18 35	19 06
45	18 22	20 02	17 42	18 05	18 28	18 54
50	18 24	20 15	17 45	18 02	18 20	18 41
52	18 25	20 22	17 46	18 01	18 17	18 34
54	18 26	20 29	17 48	18 00	18 13	18 27
56	18 27	20 38	17 49	17 58	18 08	18 20
58	18 28	20 48	17 51	17 57	18 03	18 11
60	18 30	21 00	17 53	17 55	17 58	18 01
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
14	11 13	14 15	14 08	15 35	2 15
15	12 06	14 12	14 07	15 32	2 11
16	12 58	14 09	14 06	15 29	2 07
17	13 51	14 06	14 05	15 26	2 03

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.4	0.1
30	0.4	0.3	0.1
45	0.4	0.2	0.0
60	0.4	0.1	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	14	15	16
°	′	′	′
0	21.0	21.0	20.6
4	21.0	21.0	20.6
8	21.0	21.0	20.6
12	20.9	20.9	20.5
16	20.8	20.8	20.4
20	20.7	20.7	20.4
24	20.6	20.6	20.2
28	20.4	20.4	20.1
32	20.3	20.3	20.0
36	20.1	20.1	19.8
40	19.9	19.9	19.6
44	19.7	19.7	19.4
48	19.5	19.5	19.2
52	19.2	19.2	19.0
56	19.0	19.0	18.8
60	18.7	18.7	18.5
64	18.5	18.5	18.3
68	18.2	18.2	18.0
72	17.9	17.9	17.7
76	17.6	17.6	17.5
80	17.3	17.3	17.2
84	17.0	17.0	16.9
88	16.8	16.8	16.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	14	15	16
°	′	′	′
0	12.4	12.4	12.6
4	12.5	12.5	12.7
8	12.5	12.5	12.7
12	12.5	12.5	12.8
16	12.6	12.6	12.8
20	12.7	12.7	12.9
24	12.9	12.9	13.0
28	13.0	13.0	13.2
32	13.2	13.2	13.3
36	13.3	13.3	13.5
40	13.5	13.5	13.7
44	13.7	13.7	13.9
48	14.0	14.0	14.1
52	14.2	14.2	14.3
56	14.4	14.4	14.5
60	14.7	14.7	14.8
64	15.0	15.0	15.0
68	15.2	15.2	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.1	16.1	16.1
84	16.4	16.4	16.4
88	16.6	16.6	16.6
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.3 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
17 0	174 16.3	148 08.1	+17 40.9	148 39.0	+10 36.1	128 04.1	+16 33.3	329 10.4	− 7 29.5	159 40.0	89	+11 21.1	+156
1	189 18.8	163 10.2	41.4	163 39.7	36.8	143 06.1	33.4	344 13.0	29.4	174 07.9	89	11 36.7	+155
2	204 21.2	178 12.2	41.9	178 40.4	37.5	158 08.1	33.6	359 15.6	29.4	188 35.8	89	11 52.2	+154
3	219 23.7	193 14.2	•• 42.4	193 41.2	•• 38.2	173 10.0	•• 33.7	14 18.2	•• 29.3	203 03.7	89	•12 07.6	+154
4	234 26.2	208 16.2	42.9	208 41.9	38.9	188 12.0	33.8	29 20.8	29.2	217 31.6	88	12 23.0	+152
5	249 28.6	223 18.2	43.4	223 42.6	39.5	203 14.0	34.0	44 23.4	29.2	231 59.4	88	12 38.2	+151
6	264 31.1	238 20.3	+17 43.9	238 43.4	+10 40.2	218 16.0	+16 34.1	59 26.0	− 7 29.1	246 27.2	88	+12 53.3	+151
7	279 33.6	253 22.3	44.4	253 44.1	40.9	233 18.0	34.2	74 28.6	29.1	260 55.0	87	13 08.4	+150
8	294 36.0	268 24.3	44.9	268 44.8	41.6	248 20.0	34.4	89 31.2	29.0	275 22.7	87	13 23.4	+148
9	309 38.5	283 26.4	•• 45.3	283 45.6	•• 42.3	263 22.0	•• 34.5	104 33.9	•• 28.9	289 50.4	86	•13 38.2	+148
10	324 41.0	298 28.4	45.8	298 46.3	43.0	278 24.0	34.6	119 36.5	28.9	304 18.0	86	13 53.0	+147
11	339 43.4	313 30.5	46.3	313 47.0	43.7	293 26.0	34.8	134 39.1	28.8	318 45.6	86	14 07.7	+145
12	354 45.9	328 32.5	+17 46.8	328 47.8	+10 44.3	308 28.0	+16 34.9	149 41.7	− 7 28.8	333 13.2	85	+14 22.2	+145
13	9 48.3	343 34.6	47.3	343 48.5	45.0	323 30.0	35.1	164 44.3	28.7	347 40.7	85	14 36.7	+144
14	24 50.8	358 36.6	47.8	358 49.2	45.7	338 32.0	35.2	179 46.9	28.6	2 08.2	85	14 51.1	+142
15	39 53.3	13 38.7	•• 48.2	13 50.0	•• 46.4	353 34.0	•• 35.3	194 49.5	•• 28.6	16 35.7	84	•15 05.3	+142
16	54 55.7	28 40.8	48.7	28 50.7	47.1	8 36.0	35.5	209 52.1	28.5	31 03.1	84	15 19.5	+140
17	69 58.2	43 42.8	49.2	43 51.4	47.8	23 38.0	35.6	224 54.7	28.4	45 30.5	83	15 33.5	+140
18	85 00.7	58 44.9	+17 49.7	58 52.2	+10 48.4	38 40.0	+16 35.7	239 57.3	− 7 28.4	59 57.8	84	+15 47.5	+138
19	100 03.1	73 47.0	50.1	73 52.9	49.1	53 42.0	35.9	254 59.9	28.3	74 25.2	82	16 01.3	+137
20	115 05.6	88 49.1	50.6	88 53.6	49.8	68 44.0	36.0	270 02.5	28.3	88 52.4	82	16 15.0	+136
21	130 08.1	103 51.1	•• 51.1	103 54.4	•• 50.5	83 46.0	•• 36.1	285 05.1	•• 28.2	103 19.6	82	•16 28.6	+135
22	145 10.5	118 53.2	51.5	118 55.1	51.2	98 48.0	36.3	300 07.7	28.1	117 46.8	82	16 42.1	+134
23	160 13.0	133 55.3	52.0	133 55.8	51.8	113 50.0	36.4	315 10.3	28.1	132 14.0	81	16 55.5	+133
18 0	175 15.5	148 57.4	+17 52.5	148 56.5	+10 52.5	128 52.0	+16 36.6	330 13.0	− 7 28.0	146 41.1	81	+17 08.8	+131
1	190 17.9	163 59.5	52.9	163 57.3	53.2	143 54.0	36.7	345 15.6	27.9	161 08.2	80	17 21.9	+130
2	205 20.4	179 01.6	53.4	178 58.0	53.9	158 56.0	36.8	0 18.2	27.9	175 35.2	80	17 34.9	+129
3	220 22.8	194 03.7	•• 53.9	193 58.7	•• 54.6	173 57.9	•• 37.0	15 20.8	•• 27.8	190 02.2	79	•17 47.8	+128
4	235 25.3	209 05.8	54.3	208 59.5	55.3	188 59.9	37.1	30 23.4	27.8	204 29.1	79	18 00.6	+126
5	250 27.8	224 07.9	54.8	224 00.2	55.9	204 01.9	37.2	45 26.0	27.7	218 56.0	79	18 13.2	+125
6	265 30.2	239 10.0	+17 55.2	239 00.9	+10 56.6	219 03.9	+16 37.4	60 28.6	− 7 27.6	233 22.9	78	+18 25.7	+124
7	280 32.7	254 12.2	55.7	254 01.7	57.3	234 05.9	37.5	75 31.2	27.6	247 49.7	78	18 38.1	+123
8	295 35.2	269 14.3	56.1	269 02.4	58.0	249 07.9	37.7	90 33.8	27.5	262 16.5	78	18 50.4	+121
9	310 37.6	284 16.4	•• 56.6	284 03.1	•• 58.7	264 09.9	•• 37.8	105 36.4	•• 27.5	276 43.3	77	•19 02.5	+120
10	325 40.1	299 18.5	57.0	299 03.9	10 59.3	279 11.9	37.9	120 39.0	27.4	291 10.0	77	19 14.5	+119
11	340 42.6	314 20.7	57.5	314 04.6	11 00.0	294 13.9	38.1	135 41.6	27.3	305 36.7	76	19 26.4	+117
12	355 45.0	329 22.8	+17 57.9	329 05.3	+11 00.7	309 15.9	+16 38.2	150 44.3	− 7 27.3	320 03.3	76	+19 38.1	+116
13	10 47.5	344 24.9	58.3	344 06.1	01.4	324 17.9	38.3	165 46.9	27.2	334 29.9	75	19 49.7	+115
14	25 50.0	359 27.1	58.8	359 06.8	02.1	339 19.9	38.5	180 49.5	27.1	348 56.4	76	20 01.2	+113
15	40 52.4	14 29.2	•• 59.2	14 07.5	•• 02.7	354 21.9	•• 38.6	195 52.1	•• 27.1	3 23.0	74	•20 12.5	+112
16	55 54.9	29 31.4	17 59.7	29 08.2	03.4	9 23.8	38.7	210 54.7	27.0	17 49.4	75	20 23.7	+111
17	70 57.3	44 33.5	18 00.1	44 09.0	04.1	24 25.8	38.9	225 57.3	27.0	32 15.9	74	20 34.8	+109
18	85 59.8	59 35.7	+18 00.5	59 09.7	+11 04.8	39 27.8	+16 39.0	240 59.9	− 7 26.9	46 42.3	73	+20 45.7	+108
19	101 02.3	74 37.8	00.9	74 10.4	05.4	54 29.8	39.2	256 02.5	26.8	61 08.6	74	20 56.5	+106
20	116 04.7	89 40.0	01.4	89 11.2	06.1	69 31.8	39.3	271 05.1	26.8	75 35.0	73	21 07.1	+105
21	131 07.2	104 42.2	•• 01.8	104 11.9	•• 06.8	84 33.8	•• 39.4	286 07.7	•• 26.7	90 01.3	72	•21 17.6	+103
22	146 09.7	119 44.3	02.2	119 12.6	07.5	99 35.8	39.6	301 10.4	26.6	104 27.5	73	21 27.9	+103
23	161 12.1	134 46.5	02.7	134 13.4	08.2	114 37.8	39.7	316 13.0	26.6	118 53.8	72	21 38.2	+100
19 0	176 14.6	149 48.7	+18 03.1	149 14.1	+11 08.8	129 39.8	+16 39.8	331 15.6	− 7 26.5	133 20.0	71	+21 48.2	+ 99
1	191 17.1	164 50.9	03.5	164 14.8	09.5	144 41.8	40.0	346 18.2	26.5	147 46.1	72	21 58.1	+ 98
2	206 19.5	179 53.1	03.9	179 15.5	10.2	159 43.8	40.1	1 20.8	26.4	162 12.3	71	22 07.9	+ 96
3	221 22.0	194 55.2	•• 04.3	194 16.3	•• 10.9	174 45.7	•• 40.3	16 23.4	•• 26.3	176 38.4	70	•22 17.5	+ 95
4	236 24.4	209 57.4	04.7	209 17.0	11.5	189 47.7	40.4	31 26.0	26.3	191 04.4	71	22 27.0	+ 93
5	251 26.9	224 59.6	05.2	224 17.7	12.2	204 49.7	40.5	46 28.6	26.2	205 30.5	70	22 36.3	+ 91
6	266 29.4	240 01.8	+18 05.6	239 18.5	+11 12.9	219 51.7	+16 40.7	61 31.2	− 7 26.1	219 56.5	70	+22 45.4	+ 91
7	281 31.8	255 04.0	06.0	254 19.2	13.6	234 53.7	40.8	76 33.8	26.1	234 22.5	69	22 54.5	+ 88
8	296 34.3	270 06.2	06.4	269 19.9	14.2	249 55.7	40.9	91 36.5	26.0	248 48.4	69	23 03.3	+ 87
9	311 36.8	285 08.5	•• 06.8	284 20.7	•• 14.9	264 57.7	•• 41.1	106 39.1	•• 25.9	263 14.3	69	•23 12.0	+ 86
10	326 39.2	300 10.7	07.2	299 21.4	15.6	279 59.7	41.2	121 41.7	25.9	277 40.2	69	23 20.6	+ 84
11	341 41.7	315 12.9	07.6	314 22.1	16.3	295 01.7	41.4	136 44.3	25.8	292 06.1	69	23 29.0	+ 82
12	356 44.2	330 15.1	+18 08.0	329 22.8	+11 16.9	310 03.6	+16 41.5	151 46.9	− 7 25.8	306 32.0	68	+23 37.2	+ 81
13	11 46.6	345 17.3	08.4	344 23.6	17.6	325 05.6	41.6	166 49.5	25.7	320 57.8	68	23 45.3	+ 80
14	26 49.1	0 19.6	08.8	359 24.3	18.3	340 07.6	41.8	181 52.1	25.6	335 23.6	68	23 53.3	+ 77
15	41 51.6	15 21.8	•• 09.2	14 25.0	•• 19.0	355 09.6	•• 41.9	196 54.7	•• 25.6	349 49.4	68	•24 01.0	+ 77
16	56 54.0	30 24.0	09.6	29 25.8	19.6	10 11.6	42.0	211 57.3	25.5	4 15.2	67	24 08.7	+ 74
17	71 56.5	45 26.3	10.0	44 26.5	20.3	25 13.6	42.2	227 00.0	25.4	18 40.9	67	24 16.1	+ 73
18	86 58.9	60 28.5	+18 10.4	59 27.2	+11 21.0	40 15.6	+16 42.3	242 02.6	− 7 25.4	33 06.6	67	+24 23.4	+ 72
19	102 01.4	75 30.8	10.8	74 27.9	21.7	55 17.6	42.5	257 05.2	25.3	47 32.3	67	24 30.6	+ 70
20	117 03.9	90 33.0	11.1	89 28.7	22.3	70 19.5	42.6	272 07.8	25.3	61 58.0	67	24 37.6	+ 68
21	132 06.3	105 35.3	•• 11.5	104 29.4	•• 23.0	85 21.5	•• 42.7	287 10.4	•• 25.2	76 23.7	67	•24 44.4	+ 67
22	147 08.8	120 37.5	11.9	119 30.1	23.7	100 23.5	42.9	302 13.0	25.1	90 49.4	67	24 51.1	+ 65
23	162 11.3	135 39.8	12.3	134 30.9	24.3	115 25.5	43.0	317 15.6	25.1	105 15.1	66	24 57.6	+ 63
24	177 13.7	150 42.1	+18 12.7	149 31.6	+11 25.0	130 27.5	+16 43.1	332 18.2	− 7 25.0	119 40.7	66	+25 03.9	+ 62
code	−	+ 21	+ 4	+ 8	+ 7	+ 20	+ 1	+ 26	+ 1				

GMT	h	SUN GHA	Dec.
		° ′	° ′
17	0	177 50.9	− 1 32.9
	1	192 51.1	31.9
	2	207 51.2	31.0
	3	222 51.4	30.0
	4	237 51.6	29.0
	5	252 51.8	28.0
	6	267 52.0	− 1 27.0
	7	282 52.1	26.0
	8	297 52.3	25.0
	9	312 52.5	24.0
	10	327 52.7	23.0
	11	342 52.9	22.1
	12	357 53.0	− 1 21.1
	13	12 53.2	20.1
	14	27 53.4	19.1
	15	42 53.6	18.1
	16	57 53.8	17.1
	17	72 53.9	16.1
	18	87 54.1	− 1 15.1
	19	102 54.3	14.1
	20	117 54.5	13.2
	21	132 54.7	12.2
	22	147 54.8	11.2
	23	162 55.0	10.2
18	0	177 55.2	− 1 09.2
	1	192 55.4	08.2
	2	207 55.6	07.2
	3	222 55.7	06.2
	4	237 55.9	05.2
	5	252 56.1	04.3
	6	267 56.3	− 1 03.3
	7	282 56.5	02.3
	8	297 56.7	01.3
	9	312 56.8	− 1 00.3
	10	327 57.0	0 59.3
	11	342 57.2	58.3
	12	357 57.4	− 0 57.3
	13	12 57.6	56.3
	14	27 57.7	55.4
	15	42 57.9	54.4
	16	57 58.1	53.4
	17	72 58.3	52.4
	18	87 58.5	− 0 51.4
	19	102 58.7	50.4
	20	117 58.8	49.4
	21	132 59.0	48.4
	22	147 59.2	47.5
	23	162 59.4	46.5
19	0	177 59.6	− 0 45.5
	1	192 59.8	44.5
	2	207 59.9	43.5
	3	223 00.1	42.5
	4	238 00.3	41.5
	5	253 00.5	40.5
	6	268 00.7	− 0 39.5
	7	283 00.9	38.6
	8	298 01.0	37.6
	9	313 01.2	36.6
	10	328 01.4	35.6
	11	343 01.6	34.6
	12	358 01.8	− 0 33.6
	13	13 02.0	32.6
	14	28 02.1	31.6
	15	43 02.3	30.6
	16	58 02.5	29.7
	17	73 02.7	28.7
	18	88 02.9	− 0 27.7
	19	103 03.1	26.7
	20	118 03.3	25.7
	21	133 03.4	24.7
	22	148 03.6	23.7
	23	163 03.8	22.7
	24	178 04.0	− 0 21.7
code		−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.5	−62 50.5
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.4
55	Al Na'ir	28 40.7	−47 11.3
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.5	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.6	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 04.1	−68 56.6
22	Avior	234 36.3	−59 21.7
13	Bellatrix	279 20.5	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.2	−52 40.4
12	Capella	281 41.4	+45 57.4
53	Deneb	50 02.7	+45 06.5
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.2	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.3
31	Gacrux	172 51.0	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 51.8	−60 08.9
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.8	−34 24.6
40	Kochab	137 16.6	+74 20.4
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.0	−69 31.7
9	Mirfak	309 45.5	+49 42.0
50	Nunki	76 54.4	−26 21.5
52	Peacock	54 30.6	−56 53.1
21	Pollux	244 22.7	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.4	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.5	− 8 15.3
38	Rigil Kent.	140 53.3	−60 38.7
44	Sabik	103 04.3	−15 40.3
3	Schedar	350 32.9	+56 17.0
45	Shaula	97 23.3	−37 04.3
18	Sirius	259 13.5	−16 39.1
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.5	−43 14.8
49	Vega	81 09.7	+38 44.0
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 17	18	19
h	m s	m s	m s
0	− 8 36.9	− 8 19.6	− 8 02.1
6	− 8 32.6	− 8 15.2	− 7 57.7
12	− 8 28.2	− 8 10.8	− 7 53.3
18	− 8 23.9	− 8 06.5	− 7 48.8
24	− 8 19.6	− 8 02.1	− 7 44.4

Lat.	Sunrise	Twlt. begins	Moonrise 17	18	19	20
N °	h m	h m	h m	h m	h m	h m
72	6 10	1 31	4 41	3 06	▭	▭
70	6 10	2 18	5 02	4 12	▭	▭
68	6 09	2 48	5 19	4 49	▭	▭
66	6 09	3 08	5 33	5 16	4 46	▭
64	6 09	3 23	5 44	5 36	5 26	5 05
62	6 09	3 37	5 54	5 53	5 54	6 00
60	6 09	3 48	6 02	6 07	6 16	6 33
58	6 08	3 56	6 10	6 19	6 34	6 57
56	6 08	4 04	6 16	6 30	6 49	7 17
54	6 08	4 11	6 22	6 39	7 02	7 33
52	6 08	4 16	6 28	6 47	7 13	7 48
50	6 08	4 21	6 32	6 55	7 23	8 00
45	6 08	4 30	6 43	7 11	7 45	8 26
40	6 07	4 38	6 52	7 24	8 02	8 46
35	6 07	4 44	7 00	7 36	8 17	9 03
30	6 07	4 48	7 06	7 46	8 30	9 18
20	6 06	4 54	7 18	8 03	8 52	9 43
10	6 06	4 56	7 29	8 18	9 11	10 05
0	6 05	4 56	7 38	8 33	9 29	10 26
10	6 04	4 54	7 48	8 47	9 47	10 46
20	6 03	4 50	7 59	9 03	10 06	11 09
30	6 02	4 41	8 11	9 21	10 29	11 34
35	6 01	4 35	8 19	9 31	10 42	11 49
40	6 01	4 28	8 27	9 44	10 58	12 07
45	6 00	4 19	8 37	9 58	11 16	12 29
50	5 58	4 06	8 48	10 16	11 40	12 56
52	5 58	4 00	8 54	10 24	11 51	13 09
54	5 57	3 53	9 00	10 34	12 03	13 24
56	5 56	3 44	9 07	10 44	12 18	13 42
58	5 56	3 35	9 14	10 56	12 35	14 04
60	5 55	3 24	9 23	11 11	12 57	14 32
S						

Lat.	Sunset	Twlt. ends	Moonset 17	18	19	20
N °	h m	h m	h m	h m	h m	h m
72	18 09	23 03	25 07	1 07	▭	▭
70	18 09	22 09	24 02	0 02	▭	▭
68	18 09	21 38	23 26	▭	▭	▭
66	18 09	21 16	23 02	25 28	1 28	▭
64	18 09	20 59	22 42	24 49	0 49	3 10
62	18 09	20 45	22 27	24 21	0 21	2 15
60	18 09	20 34	22 14	24 00	0 00	1 42
58	18 09	20 25	22 02	23 43	25 18	1 18
56	18 09	20 17	21 53	23 29	24 59	0 59
54	18 09	20 10	21 44	23 16	24 42	0 42
52	18 09	20 04	21 37	23 06	24 29	0 29
50	18 09	19 58	21 30	22 56	24 16	0 16
45	18 10	19 49	21 15	22 36	23 51	24 59
40	18 10	19 41	21 03	22 19	23 32	24 37
35	18 10	19 35	20 53	22 05	23 15	24 19
30	18 10	19 30	20 45	21 54	23 01	24 03
20	18 11	19 24	20 29	21 33	22 36	23 37
10	18 11	19 21	20 16	21 16	22 15	23 14
0	18 11	19 20	20 04	20 59	21 56	22 53
10	18 12	19 22	19 52	20 43	21 37	22 32
20	18 13	19 26	19 39	20 25	21 16	22 09
30	18 14	19 34	19 24	20 05	20 52	21 43
35	18 14	19 39	19 15	19 54	20 38	21 27
40	18 15	19 46	19 06	19 41	20 21	21 09
45	18 16	19 55	18 54	19 25	20 02	20 47
50	18 17	20 07	18 41	19 06	19 38	20 20
52	18 17	20 13	18 34	18 57	19 26	20 07
54	18 18	20 20	18 27	18 47	19 13	19 51
56	18 19	20 28	18 20	18 35	18 58	19 33
58	18 19	20 36	18 11	18 22	18 40	19 11
60	18 20	20 47	18 01	18 07	18 19	18 42
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
17	13 51	14 06	14 05	15 26	2 03
18	14 46	14 02	14 04	15 23	1 59
19	15 42	13 59	14 02	15 19	1 55
20	16 40	13 55	14 01	15 16	1 51

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.4	0.1
30	0.4	0.3	0.1
45	0.4	0.2	0.0
60	0.4	0.2	0.0
75	0.4	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	17	18	19
°	′	′	′
0	19.7	18.7	17.5
4	19.7	18.7	17.5
8	19.7	18.7	17.4
12	19.7	18.7	17.4
16	19.6	18.6	17.4
20	19.5	18.6	17.4
24	19.4	18.5	17.3
28	19.3	18.4	17.3
32	19.2	18.3	17.2
36	19.1	18.2	17.1
40	18.9	18.1	17.1
44	18.7	18.0	17.0
48	18.6	17.8	16.9
52	18.4	17.7	16.8
56	18.2	17.6	16.8
60	18.0	17.4	16.7
64	17.8	17.2	16.6
68	17.6	17.1	16.5
72	17.4	16.9	16.4
76	17.1	16.8	16.3
80	16.9	16.6	16.2
84	16.7	16.4	16.1
88	16.5	16.3	16.0
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	17	18	19
°	′	′	′
0	13.2	13.7	14.5
4	13.2	13.7	14.5
8	13.2	13.8	14.5
12	13.2	13.8	14.5
16	13.3	13.9	14.5
20	13.4	13.9	14.6
24	13.5	14.0	14.6
28	13.6	14.1	14.7
32	13.7	14.2	14.7
36	13.8	14.3	14.8
40	14.0	14.4	14.8
44	14.2	14.5	14.9
48	14.3	14.6	15.0
52	14.5	14.8	15.1
56	14.7	14.9	15.2
60	14.9	15.1	15.3
64	15.1	15.2	15.3
68	15.3	15.4	15.4
72	15.5	15.5	15.5
76	15.8	15.7	15.6
80	16.0	15.9	15.8
84	16.2	16.1	15.9
88	16.4	16.2	15.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
20 0	177 13.7	150 42.1	+18 12.7	149 31.6	+11 25.0	130 27.5	+16 43.1	332 18.2	− 7 25.0	119 40.7	66	+25 03.9	+ 62
1	192 16.2	165 44.3	13.0	164 32.3	25.7	145 29.5	43.3	347 20.9	24.9	134 06.3	67	25 10.1	+ 61
2	207 18.7	180 46.6	13.4	179 33.0	26.4	160 31.5	43.4	2 23.5	24.9	148 32.0	66	25 16.2	+ 58
3	222 21.1	195 48.9	•• 13.8	194 33.8	•• 27.0	175 33.5	•• 43.6	17 26.1	•• 24.8	162 57.6	66	•25 22.0	+ 57
4	237 23.6	210 51.2	14.2	209 34.5	27.7	190 35.4	43.7	32 28.7	24.7	177 23.2	66	25 27.7	+ 56
5	252 26.1	225 53.4	14.5	224 35.2	28.4	205 37.4	43.8	47 31.3	24.7	191 48.8	66	25 33.3	+ 54
6	267 28.5	240 55.7	+18 14.9	239 36.0	+11 29.0	220 39.4	+16 44.0	62 33.9	− 7 24.6	206 14.4	67	+25 38.7	+ 52
7	282 31.0	255 58.0	15.3	254 36.7	29.7	235 41.4	44.1	77 36.5	24.6	220 40.1	66	25 43.9	+ 50
8	297 33.4	271 00.3	15.6	269 37.4	30.4	250 43.4	44.2	92 39.2	24.5	235 05.7	66	25 48.9	+ 49
9	312 35.9	286 02.6	•• 16.0	284 38.1	•• 31.1	265 45.4	•• 44.4	107 41.8	•• 24.4	249 31.3	66	•25 53.8	+ 48
10	327 38.4	301 04.9	16.4	299 38.9	31.7	280 47.3	44.5	122 44.4	24.4	263 56.9	66	25 58.6	+ 45
11	342 40.8	316 07.2	16.7	314 39.6	32.4	295 49.3	44.7	137 47.0	24.3	278 22.5	66	26 03.1	+ 45
12	357 43.3	331 09.5	+18 17.1	329 40.3	+11 33.1	310 51.3	+16 44.8	152 49.6	− 7 24.2	292 48.1	67	+26 07.6	+ 42
13	12 45.8	346 11.8	17.4	344 41.1	33.7	325 53.3	44.9	167 52.2	24.2	307 13.8	66	26 11.8	+ 41
14	27 48.2	1 14.2	17.8	359 41.8	34.4	340 55.3	45.1	182 54.8	24.1	321 39.4	67	26 15.9	+ 39
15	42 50.7	16 16.5	•• 18.1	14 42.5	•• 35.1	355 57.3	•• 45.2	197 57.4	•• 24.0	336 05.1	66	•26 19.8	+ 38
16	57 53.2	31 18.8	18.5	29 43.2	35.7	10 59.3	45.3	213 00.1	24.0	350 30.7	67	26 23.6	+ 36
17	72 55.6	46 21.1	18.8	44 44.0	36.4	26 01.2	45.5	228 02.7	23.9	4 56.4	67	26 27.2	+ 34
18	87 58.1	61 23.5	+18 19.2	59 44.7	+11 37.1	41 03.2	+16 45.6	243 05.3	− 7 23.9	19 22.1	67	+26 30.6	+ 33
19	103 00.6	76 25.8	19.5	74 45.4	37.7	56 05.2	45.8	258 07.9	23.8	33 47.8	67	26 33.9	+ 31
20	118 03.0	91 28.2	19.9	89 46.2	38.4	71 07.2	45.9	273 10.5	23.7	48 13.5	68	26 37.0	+ 29
21	133 05.5	106 30.5	•• 20.2	104 46.9	•• 39.1	86 09.2	•• 46.0	288 13.1	•• 23.7	62 39.3	67	•26 39.9	+ 28
22	148 07.9	121 32.8	20.5	119 47.6	39.7	101 11.2	46.2	303 15.8	23.6	77 05.0	68	26 42.7	+ 27
23	163 10.4	136 35.2	20.9	134 48.3	40.4	116 13.1	46.3	318 18.4	23.5	91 30.8	68	26 45.4	+ 24
21 0	178 12.9	151 37.5	+18 21.2	149 49.1	+11 41.1	131 15.1	+16 46.5	333 21.0	− 7 23.5	105 56.6	68	+26 47.8	+ 23
1	193 15.3	166 39.9	21.5	164 49.8	41.7	146 17.1	46.6	348 23.6	23.4	120 22.4	69	26 50.1	+ 22
2	208 17.8	181 42.3	21.9	179 50.5	42.4	161 19.1	46.7	3 26.2	23.3	134 48.3	69	26 52.3	+ 20
3	223 20.3	196 44.6	•• 22.2	194 51.2	•• 43.1	176 21.1	•• 46.9	18 28.8	•• 23.3	149 14.2	69	•26 54.3	+ 18
4	238 22.7	211 47.0	22.5	209 52.0	43.7	191 23.0	47.0	33 31.4	23.2	163 40.1	69	26 56.1	+ 17
5	253 25.2	226 49.4	22.8	224 52.7	44.4	206 25.0	47.1	48 34.1	23.1	178 06.0	70	26 57.8	+ 15
6	268 27.7	241 51.8	+18 23.2	239 53.4	+11 45.1	221 27.0	+16 47.3	63 36.7	− 7 23.1	192 32.0	70	+26 59.3	+ 13
7	283 30.1	256 54.1	23.5	254 54.2	45.7	236 29.0	47.4	78 39.3	23.0	206 58.0	71	27 00.6	+ 12
8	298 32.6	271 56.5	23.8	269 54.9	46.4	251 31.0	47.6	93 41.9	23.0	221 24.1	71	27 01.8	+ 11
9	313 35.0	286 58.9	•• 24.1	284 55.6	•• 47.1	266 32.9	•• 47.7	108 44.5	•• 22.9	235 50.2	71	•27 02.9	+ 8
10	328 37.5	302 01.3	24.4	299 56.3	47.7	281 34.9	47.8	123 47.1	22.8	250 16.3	71	27 03.7	+ 8
11	343 40.0	317 03.7	24.7	314 57.1	48.4	296 36.9	48.0	138 49.7	22.8	264 42.4	72	27 04.5	+ 5
12	358 42.4	332 06.1	+18 25.1	329 57.8	+11 49.1	311 38.9	+16 48.1	153 52.4	− 7 22.7	279 08.6	73	+27 05.0	+ 4
13	13 44.9	347 08.5	25.4	344 58.5	49.7	326 40.9	48.2	168 55.0	22.6	293 34.9	73	27 05.4	+ 3
14	28 47.4	2 10.9	25.7	359 59.2	50.4	341 42.9	48.4	183 57.6	22.6	308 01.2	73	27 05.7	+ 1
15	43 49.8	17 13.3	•• 26.0	15 00.0	•• 51.1	356 44.8	•• 48.5	199 00.2	•• 22.5	322 27.5	74	•27 05.8	− 1
16	58 52.3	32 15.8	26.3	30 00.7	51.7	11 46.8	48.7	214 02.8	22.4	336 53.9	74	27 05.7	− 2
17	73 54.8	47 18.2	26.6	45 01.4	52.4	26 48.8	48.8	229 05.4	22.4	351 20.3	74	27 05.5	− 3
18	88 57.2	62 20.6	+18 26.9	60 02.1	+11 53.1	41 50.8	+16 48.9	244 08.1	− 7 22.3	5 46.7	76	+27 05.2	− 5
19	103 59.7	77 23.0	27.2	75 02.9	53.7	56 52.7	49.1	259 10.7	22.2	20 13.3	75	27 04.7	− 7
20	119 02.2	92 25.5	27.5	90 03.6	54.4	71 54.7	49.2	274 13.3	22.2	34 39.8	77	27 04.0	− 8
21	134 04.6	107 27.9	•• 27.8	105 04.3	•• 55.0	86 56.7	•• 49.4	289 15.9	•• 22.1	49 06.5	76	•27 03.2	− 10
22	149 07.1	122 30.3	28.1	120 05.0	55.7	101 58.7	49.5	304 18.5	22.0	63 33.1	78	27 02.2	− 11
23	164 09.5	137 32.8	28.3	135 05.8	56.4	117 00.7	49.6	319 21.1	22.0	77 59.9	77	27 01.1	− 13
22 0	179 12.0	152 35.2	+18 28.6	150 06.5	+11 57.0	132 02.6	+16 49.8	334 23.8	− 7 21.9	92 26.6	79	+26 59.8	− 14
1	194 14.5	167 37.7	28.9	165 07.2	57.7	147 04.6	49.9	349 26.4	21.9	106 53.5	79	26 58.4	− 15
2	209 16.9	182 40.1	29.2	180 08.0	58.3	162 06.6	50.0	4 29.0	21.8	121 20.4	79	26 56.9	− 17
3	224 19.4	197 42.6	•• 29.5	195 08.7	•• 59.0	177 08.6	•• 50.2	19 31.6	•• 21.7	135 47.3	81	•26 55.2	− 19
4	239 21.9	212 45.0	29.8	210 09.4	11 59.7	192 10.6	50.3	34 34.2	21.7	150 14.4	80	26 53.3	− 20
5	254 24.3	227 47.5	30.0	225 10.1	12 00.3	207 12.5	50.5	49 36.9	21.6	164 41.4	82	26 51.3	− 21
6	269 26.8	242 50.0	+18 30.3	240 10.9	+12 01.0	222 14.5	+16 50.6	64 39.5	− 7 21.5	179 08.6	82	+26 49.2	− 23
7	284 29.3	257 52.5	30.6	255 11.6	01.7	237 16.5	50.7	79 42.1	21.5	193 35.8	83	26 46.9	− 24
8	299 31.7	272 54.9	30.9	270 12.3	02.3	252 18.5	50.9	94 44.7	21.4	208 03.1	83	26 44.5	− 26
9	314 34.2	287 57.4	•• 31.1	285 13.0	•• 03.0	267 20.4	•• 51.0	109 47.3	•• 21.3	222 30.4	84	•26 41.9	− 27
10	329 36.7	302 59.9	31.4	300 13.8	03.6	282 22.4	51.2	124 49.9	21.3	236 57.8	85	26 39.2	− 28
11	344 39.1	318 02.4	31.6	315 14.5	04.3	297 24.4	51.3	139 52.6	21.2	251 25.3	85	26 36.4	− 30
12	359 41.6	333 04.9	+18 31.9	330 15.2	+12 05.0	312 26.4	+16 51.4	154 55.2	− 7 21.1	265 52.8	86	+26 33.4	− 31
13	14 44.0	348 07.4	32.2	345 15.9	05.6	327 28.3	51.6	169 57.8	21.1	280 20.4	87	26 30.3	− 33
14	29 46.5	3 09.9	32.4	0 16.7	06.3	342 30.3	51.7	185 00.4	21.0	294 48.1	88	26 27.0	− 34
15	44 49.0	18 12.4	•• 32.7	15 17.4	•• 06.9	357 32.3	•• 51.8	200 03.0	•• 20.9	309 15.9	88	•26 23.6	− 35
16	59 51.4	33 14.9	32.9	30 18.1	07.6	12 34.3	52.0	215 05.7	20.9	323 43.7	89	26 20.1	− 37
17	74 53.9	48 17.4	33.2	45 18.8	08.2	27 36.3	52.1	230 08.3	20.8	338 11.6	90	26 16.4	− 38
18	89 56.4	63 19.9	+18 33.4	60 19.6	+12 08.9	42 38.2	+16 52.3	245 10.9	− 7 20.7	352 39.6	90	+26 12.6	− 39
19	104 58.8	78 22.4	33.7	75 20.3	09.6	57 40.2	52.4	260 13.5	20.7	7 07.6	91	26 08.7	− 41
20	120 01.3	93 25.0	33.9	90 21.0	10.2	72 42.2	52.5	275 16.1	20.6	21 35.7	92	26 04.6	− 42
21	135 03.8	108 27.5	•• 34.2	105 21.7	•• 10.9	87 44.2	•• 52.7	290 18.7	•• 20.5	36 03.9	93	•26 00.4	− 43
22	150 06.2	123 30.0	34.4	120 22.5	11.5	102 46.1	52.8	305 21.4	20.5	50 32.2	93	25 56.1	− 45
23	165 08.7	138 32.6	34.7	135 23.2	12.2	117 48.1	53.0	320 24.0	20.4	65 00.5	94	25 51.6	− 46
24	180 11.2	153 35.1	+18 34.9	150 23.9	+12 12.8	132 50.1	+16 53.1	335 26.6	− 7 20.4	79 28.9	95	+25 47.0	− 47
code	−	+ 24	+ 3	+ 7	+ 6	+ 20	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
20 0	178 04.0	− 0 21.7
1	193 04.2	20.8
2	208 04.4	19.8
3	223 04.5 ••	18.8
4	238 04.7	17.8
5	253 04.9	16.8
6	268 05.1	− 0 15.8
7	283 05.3	14.8
8	298 05.5	13.8
9	313 05.7 ••	12.9
10	328 05.8	11.9
11	343 06.0	10.9
12	358 06.2	− 0 09.9
13	13 06.4	08.9
14	28 06.6	07.9
15	43 06.8 ••	06.9
16	58 07.0	05.9
17	73 07.1	05.0
18	88 07.3	− 0 04.0
19	103 07.5	03.0
20	118 07.7	02.0
21	133 07.9	− 0 01.0
22	148 08.1	0 00.0
23	163 08.3	+ 0 01.0
21 0	178 08.4	+ 0 02.0
1	193 08.6	03.0
2	208 08.8	03.9
3	223 09.0 ••	04.9
4	238 09.2	05.9
5	253 09.4	06.9
6	268 09.6	+ 0 07.9
7	283 09.8	08.9
8	298 09.9	09.9
9	313 10.1 ••	10.9
10	328 10.3	11.8
11	343 10.5	12.8
12	358 10.7	+ 0 13.8
13	13 10.9	14.8
14	28 11.1	15.8
15	43 11.3 ••	16.8
16	58 11.4	17.8
17	73 11.6	18.8
18	88 11.8	+ 0 19.7
19	103 12.0	20.7
20	118 12.2	21.7
21	133 12.4 ••	22.7
22	148 12.6	23.7
23	163 12.8	24.7
22 0	178 12.9	+ 0 25.7
1	193 13.1	26.7
2	208 13.3	27.6
3	223 13.5 ••	28.6
4	238 13.7	29.6
5	253 13.9	30.6
6	268 14.1	+ 0 31.6
7	283 14.3	32.6
8	298 14.4	33.6
9	313 14.6 ••	34.5
10	328 14.8	35.5
11	343 15.0	36.5
12	358 15.2	+ 0 37.5
13	13 15.4	38.5
14	28 15.6	39.5
15	43 15.8 ••	40.5
16	58 16.0	41.5
17	73 16.1	42.4
18	88 16.3	+ 0 43.4
19	103 16.5	44.4
20	118 16.7	45.4
21	133 16.9 ••	46.4
22	148 17.1	47.4
23	163 17.3	48.4
24	178 17.5	+ 0 49.3
code	−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.5	−62 50.5
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.6	−47 11.3
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.5	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.6	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 04.0	−68 56.6
22	Avior	234 36.4	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.2	−52 40.4
12	Capella	281 41.4	+45 57.4
53	Deneb	50 02.7	+45 06.5
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 07.1	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.3
31	Gacrux	172 51.0	−56 51.2
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.8	−60 09.0
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.8	−34 24.6
40	Kochab	137 16.6	+74 20.4
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.1	−69 31.7
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.3	−26 21.5
52	Peacock	54 30.5	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.4	+12 35.2
26	Regulus	208 31.3	+12 51.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.3	−60 38.7
44	Sabik	103 04.3	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.3	−37 04.3
18	Sirius	259 13.5	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.5	−43 14.8
49	Vega	81 09.6	+38 44.0
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 20	21	22
h	m s	m s	m s
0	− 7 44.4	− 7 26.6	− 7 08.6
6	− 7 40.0	− 7 22.1	− 7 04.1
12	− 7 35.5	− 7 17.6	− 6 59.6
18	− 7 31.0	− 7 13.1	− 6 55.1
24	− 7 26.6	− 7 08.6	− 6 50.5

Lat.	Sunrise	Twlt. begins	Moonrise 20	21	22	23
N °	h m	h m	h m	h m	h m	h m
72	5 54	////	▭	▭	▭	▭
70	5 56	1 49	▭	▭	▭	▭
68	5 57	2 27	▭	▭	▭	▭
66	5 58	2 51	▭	▭	▭	▭
64	5 58	3 10	5 05	▭	▭	8 08
62	5 59	3 24	6 00	6 21	7 24	8 58
60	5 59	3 37	6 33	7 07	8 07	9 28
58	6 00	3 46	6 57	7 37	8 36	9 52
56	6 00	3 55	7 17	7 59	8 58	10 11
54	6 01	4 02	7 33	8 18	9 17	10 26
52	6 01	4 08	7 48	8 34	9 32	10 40
50	6 01	4 14	8 00	8 47	9 46	10 52
45	6 02	4 25	8 26	9 15	10 13	11 16
40	6 02	4 33	8 46	9 37	10 35	11 36
35	6 03	4 39	9 03	9 56	10 53	11 52
30	6 03	4 44	9 18	10 11	11 08	12 06
20	6 04	4 51	9 43	10 38	11 34	12 30
10	6 04	4 54	10 05	11 01	11 57	12 51
0	6 04	4 55	10 26	11 23	12 18	13 10
10	6 04	4 54	10 46	11 44	12 39	13 29
20	6 04	4 51	11 09	12 07	13 01	13 49
30	6 04	4 43	11 34	12 34	13 27	14 13
35	6 04	4 38	11 49	12 50	13 42	14 27
40	6 04	4 32	12 07	13 09	14 00	14 43
45	6 03	4 23	12 29	13 31	14 22	15 02
50	6 03	4 12	12 56	13 59	14 49	15 25
52	6 03	4 06	13 09	14 13	15 02	15 37
54	6 03	4 00	13 24	14 29	15 17	15 50
56	6 03	3 53	13 42	14 49	15 35	16 04
58	6 02	3 44	14 04	15 12	15 56	16 22
60	6 02	3 34	14 32	15 44	16 24	16 43
S						

Lat.	Sunset	Twlt. ends	Moonset 20	21	22	23
N °	h m	h m	h m	h m	h m	h m
72	18 23	////	▭	▭	▭	▭
70	18 21	22 38	▭	▭	▭	▭
68	18 20	21 58	▭	▭	▭	▭
66	18 19	21 31	▭	▭	▭	▭
64	18 18	21 12	3 10	▭	▭	5 53
62	18 17	20 56	2 15	3 53	4 46	5 03
60	18 17	20 44	1 42	3 07	4 03	4 31
58	18 16	20 33	1 18	2 38	3 34	4 08
56	18 15	20 24	0 59	2 15	3 11	3 49
54	18 15	20 17	0 42	1 56	2 53	3 33
52	18 15	20 11	0 29	1 40	2 37	3 19
50	18 14	20 04	0 16	1 27	2 24	3 06
45	18 13	19 52	24 59	0 59	1 56	2 41
40	18 13	19 44	24 37	0 37	1 34	2 21
35	18 12	19 37	24 19	0 19	1 16	2 04
30	18 12	19 32	24 03	0 03	1 00	1 50
20	18 11	19 24	23 37	24 34	0 34	1 25
10	18 11	19 21	23 14	24 11	0 11	1 03
0	18 11	19 20	22 53	23 49	24 43	0 43
10	18 10	19 20	22 32	23 28	24 23	0 23
20	18 10	19 23	22 09	23 05	24 01	0 01
30	18 10	19 30	21 43	22 38	23 36	24 34
35	18 10	19 34	21 27	22 22	23 21	24 21
40	18 10	19 41	21 09	22 04	23 03	24 06
45	18 10	19 49	20 47	21 41	22 42	23 47
50	18 11	20 00	20 20	21 13	22 16	23 25
52	18 11	20 06	20 07	20 59	22 03	23 14
54	18 11	20 12	19 51	20 43	21 48	23 01
56	18 11	20 19	19 33	20 24	21 31	22 47
58	18 11	20 27	19 11	20 00	21 09	22 30
60	18 11	20 36	18 42	19 29	20 42	22 10
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
20	16 40	13 55	14 01	15 16	1 51
21	17 36	13 51	14 00	15 13	1 46
22	18 30	13 47	13 59	15 10	1 42
23	19 22	13 43	13 58	15 07	1 38

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.4	0.1
30	0.4	0.3	0.1
45	0.4	0.3	0.0
60	0.4	0.2	0.0
75	0.4	0.1	0.0
90			

Moon's Lower Limb **Add**

Alt.	20	21	22
°	′	′	′
0	16.3	15.2	14.2
4	16.3	15.2	14.2
8	16.3	15.2	14.2
12	16.3	15.2	14.2
16	16.3	15.2	14.2
20	16.3	15.2	14.2
24	16.3	15.2	14.3
28	16.2	15.2	14.3
32	16.2	15.2	14.3
36	16.2	15.2	14.4
40	16.2	15.2	14.4
44	16.1	15.3	14.5
48	16.1	15.3	14.5
52	16.1	15.3	14.6
56	16.0	15.3	14.7
60	16.0	15.3	14.7
64	16.0	15.3	14.8
68	15.9	15.4	14.9
72	15.9	15.4	14.9
76	15.8	15.4	15.0
80	15.8	15.4	15.1
84	15.8	15.4	15.2
88	15.7	15.5	15.2
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	20	21	22
°	′	′	′
0	15.1	15.8	16.4
4	15.1	15.8	16.3
8	15.1	15.8	16.3
12	15.1	15.8	16.3
16	15.1	15.8	16.3
20	15.2	15.7	16.3
24	15.2	15.7	16.2
28	15.2	15.7	16.2
32	15.2	15.7	16.2
36	15.2	15.7	16.1
40	15.3	15.7	16.1
44	15.3	15.7	16.0
48	15.3	15.7	16.0
52	15.4	15.6	15.9
56	15.4	15.6	15.8
60	15.4	15.6	15.8
64	15.5	15.6	15.7
68	15.5	15.6	15.6
72	15.5	15.6	15.6
76	15.6	15.5	15.5
80	15.6	15.5	15.4
84	15.7	15.5	15.3
88	15.7	15.5	15.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
23 0	180 11.2	153 35.1	+18 34.9	150 23.9	+12 12.8	132 50.1	+16 53.1	335 26.6	− 7 20.4	79 28.9	95	+25 47.0	− 47
1	195 13.6	168 37.7	35.1	165 24.6	13.5	147 52.1	53.2	350 29.2	20.3	93 57.4	96	25 42.3	− 48
2	210 16.1	183 40.2	35.4	180 25.3	14.2	162 54.0	53.4	5 31.8	20.2	108 26.0	97	25 37.5	− 50
3	225 18.5	198 42.8	•• 35.6	195 26.1	•• 14.8	177 56.0	•• 53.5	20 34.5	•• 20.2	122 54.7	97	•25 32.5	− 51
4	240 21.0	213 45.3	35.8	210 26.8	15.5	192 58.0	53.7	35 37.1	20.1	137 23.4	98	25 27.4	− 52
5	255 23.5	228 47.9	36.1	225 27.5	16.1	207 59.9	53.8	50 39.7	20.0	151 52.2	99	25 22.2	− 53
6	270 25.9	243 50.4	+18 36.3	240 28.2	+12 16.8	223 01.9	+16 53.9	65 42.3	− 7 20.0	166 21.1	100	+25 16.9	− 55
7	285 28.4	258 53.0	36.5	255 29.0	17.4	238 03.9	54.1	80 44.9	19.9	180 50.1	100	25 11.4	− 55
8	300 30.9	273 55.6	36.7	270 29.7	18.1	253 05.9	54.2	95 47.6	19.8	195 19.1	102	25 05.9	− 57
9	315 33.3	288 58.1	•• 37.0	285 30.4	•• 18.8	268 07.8	•• 54.3	110 50.2	•• 19.8	209 48.3	102	•25 00.2	− 59
10	330 35.8	304 00.7	37.2	300 31.1	19.4	283 09.8	54.5	125 52.8	19.7	224 17.5	103	24 54.3	− 59
11	345 38.3	319 03.3	37.4	315 31.9	20.1	298 11.8	54.6	140 55.4	19.6	238 46.8	104	24 48.4	− 60
12	0 40.7	334 05.9	+18 37.6	330 32.6	+12 20.7	313 13.8	+16 54.8	155 58.0	− 7 19.6	253 16.2	104	+24 42.4	− 62
13	15 43.2	349 08.5	37.8	345 33.3	21.4	328 15.7	54.9	171 00.7	19.5	267 45.6	106	24 36.2	− 63
14	30 45.6	4 11.1	38.0	0 34.0	22.0	343 17.7	55.0	186 03.3	19.4	282 15.2	106	24 29.9	− 64
15	45 48.1	19 13.7	•• 38.2	15 34.8	•• 22.7	358 19.7	•• 55.2	201 05.9	•• 19.4	296 44.8	107	•24 23.5	− 65
16	60 50.6	34 16.3	38.4	30 35.5	23.3	13 21.7	55.3	216 08.5	19.3	311 14.5	108	24 17.0	− 66
17	75 53.0	49 18.9	38.6	45 36.2	24.0	28 23.6	55.5	231 11.1	19.2	325 44.3	109	24 10.4	− 67
18	90 55.5	64 21.5	+18 38.8	60 36.9	+12 24.6	43 25.6	+16 55.6	246 13.8	− 7 19.2	340 14.2	110	+24 03.7	− 68
19	105 58.0	79 24.1	39.0	75 37.6	25.3	58 27.6	55.7	261 16.4	19.1	354 44.2	110	23 56.9	− 70
20	121 00.4	94 26.7	39.2	90 38.4	25.9	73 29.5	55.9	276 19.0	19.0	9 14.2	111	23 49.9	− 70
21	136 02.9	109 29.3	•• 39.4	105 39.1	•• 26.6	88 31.5	•• 56.0	291 21.6	•• 19.0	23 44.3	112	•23 42.9	− 72
22	151 05.4	124 32.0	39.6	120 39.8	27.2	103 33.5	56.2	306 24.2	18.9	38 14.5	113	23 35.7	− 72
23	166 07.8	139 34.6	39.8	135 40.5	27.9	118 35.5	56.3	321 26.9	18.8	52 44.8	114	23 28.5	− 74
24 0	181 10.3	154 37.2	+18 40.0	150 41.3	+12 28.5	133 37.4	+16 56.4	336 29.5	− 7 18.8	67 15.2	115	+23 21.1	− 74
1	196 12.8	169 39.9	40.2	165 42.0	29.2	148 39.4	56.6	351 32.1	18.7	81 45.7	115	23 13.7	− 76
2	211 15.2	184 42.5	40.4	180 42.7	29.8	163 41.4	56.7	6 34.7	18.6	96 16.2	116	23 06.1	− 77
3	226 17.7	199 45.2	•• 40.5	195 43.4	•• 30.5	178 43.3	•• 56.8	21 37.4	•• 18.6	110 46.8	117	•22 58.4	− 78
4	241 20.1	214 47.8	40.7	210 44.2	31.2	193 45.3	57.0	36 40.0	18.5	125 17.5	118	22 50.6	− 78
5	256 22.6	229 50.5	40.9	225 44.9	31.8	208 47.3	57.1	51 42.6	18.4	139 48.3	119	22 42.8	− 80
6	271 25.1	244 53.1	+18 41.1	240 45.6	+12 32.5	223 49.2	+16 57.3	66 45.2	− 7 18.4	154 19.2	119	+22 34.8	− 81
7	286 27.5	259 55.8	41.2	255 46.3	33.1	238 51.2	57.4	81 47.8	18.3	168 50.1	121	22 26.7	− 81
8	301 30.0	274 58.4	41.4	270 47.0	33.8	253 53.2	57.5	96 50.5	18.2	183 21.2	121	22 18.6	− 83
9	316 32.5	290 01.1	•• 41.6	285 47.8	•• 34.4	268 55.2	•• 57.7	111 53.1	•• 18.2	197 52.3	122	•22 10.3	− 83
10	331 34.9	305 03.8	41.7	300 48.5	35.1	283 57.1	57.8	126 55.7	18.1	212 23.5	123	22 02.0	− 85
11	346 37.4	320 06.5	41.9	315 49.2	35.7	298 59.1	58.0	141 58.3	18.0	226 54.8	123	21 53.5	− 85
12	1 39.9	335 09.1	+18 42.1	330 49.9	+12 36.3	314 01.1	+16 58.1	157 01.0	− 7 18.0	241 26.1	125	+21 45.0	− 86
13	16 42.3	350 11.8	42.2	345 50.6	37.0	329 03.0	58.2	172 03.6	17.9	255 57.6	125	21 36.4	− 87
14	31 44.8	5 14.5	42.4	0 51.4	37.6	344 05.0	58.4	187 06.2	17.8	270 29.1	126	21 27.7	− 88
15	46 47.3	20 17.2	•• 42.5	15 52.1	•• 38.3	359 07.0	•• 58.5	202 08.8	•• 17.8	285 00.7	127	•21 18.9	− 89
16	61 49.7	35 19.9	42.7	30 52.8	38.9	14 08.9	58.7	217 11.4	17.7	299 32.4	127	21 10.0	− 90
17	76 52.2	50 22.6	42.8	45 53.5	39.6	29 10.9	58.8	232 14.1	17.6	314 04.1	128	21 01.0	− 91
18	91 54.6	65 25.3	+18 43.0	60 54.3	+12 40.2	44 12.9	+16 58.9	247 16.7	− 7 17.6	328 35.9	130	+20 51.9	− 92
19	106 57.1	80 28.0	43.1	75 55.0	40.9	59 14.8	59.1	262 19.3	17.5	343 07.9	130	20 42.7	− 92
20	121 59.6	95 30.7	43.3	90 55.7	41.5	74 16.8	59.2	277 21.9	17.4	357 39.9	130	20 33.5	− 93
21	137 02.0	110 33.5	•• 43.4	105 56.4	•• 42.2	89 18.8	•• 59.4	292 24.6	•• 17.4	12 11.9	132	•20 24.2	− 94
22	152 04.5	125 36.2	43.6	120 57.1	42.8	104 20.7	59.5	307 27.2	17.3	26 44.1	132	20 14.8	− 95
23	167 07.0	140 38.9	43.7	135 57.9	43.5	119 22.7	59.6	322 29.8	17.2	41 16.3	133	20 05.3	− 96
25 0	182 09.4	155 41.6	+18 43.8	150 58.6	+12 44.1	134 24.7	+16 59.8	337 32.4	− 7 17.2	55 48.6	134	+19 55.7	− 96
1	197 11.9	170 44.4	44.0	165 59.3	44.8	149 26.6	16 59.9	352 35.1	17.1	70 21.0	134	19 46.1	− 97
2	212 14.4	185 47.1	44.1	181 00.0	45.4	164 28.6	17 00.1	7 37.7	17.0	84 53.4	135	19 36.4	− 99
3	227 16.8	200 49.8	•• 44.2	196 00.7	•• 46.1	179 30.6	•• 00.2	22 40.3	•• 17.0	99 25.9	136	•19 26.5	− 98
4	242 19.3	215 52.6	44.4	211 01.5	46.7	194 32.5	00.3	37 42.9	16.9	113 58.5	137	19 16.7	− 100
5	257 21.7	230 55.3	44.5	226 02.2	47.3	209 34.5	00.5	52 45.5	16.8	128 31.2	137	19 06.7	− 100
6	272 24.2	245 58.1	+18 44.6	241 02.9	+12 48.0	224 36.5	+17 00.6	67 48.2	− 7 16.8	143 03.9	139	+18 56.7	− 101
7	287 26.7	261 00.8	44.7	256 03.6	48.6	239 38.4	00.8	82 50.8	16.7	157 36.8	138	18 46.6	− 102
8	302 29.1	276 03.6	44.8	271 04.3	49.3	254 40.4	00.9	97 53.4	16.6	172 09.6	140	18 36.4	− 103
9	317 31.6	291 06.4	•• 44.9	286 05.1	•• 49.9	269 42.4	•• 01.0	112 56.0	•• 16.6	186 42.6	140	•18 26.1	− 103
10	332 34.1	306 09.1	45.1	301 05.8	50.6	284 44.3	01.2	127 58.7	16.5	201 15.6	141	18 15.8	− 104
11	347 36.5	321 11.9	45.2	316 06.5	51.2	299 46.3	01.3	143 01.3	16.4	215 48.7	142	18 05.4	− 105
12	2 39.0	336 14.7	+18 45.3	331 07.2	+12 51.9	314 48.3	+17 01.5	158 03.9	− 7 16.4	230 21.9	142	+17 54.9	− 105
13	17 41.5	351 17.5	45.4	346 07.9	52.5	329 50.2	01.6	173 06.5	16.3	244 55.1	143	17 44.4	− 106
14	32 43.9	6 20.2	45.5	1 08.7	53.1	344 52.2	01.7	188 09.2	16.2	259 28.4	144	17 33.8	− 107
15	47 46.4	21 23.0	•• 45.6	16 09.4	•• 53.8	359 54.2	•• 01.9	203 11.8	•• 16.2	274 01.8	144	•17 23.1	− 107
16	62 48.9	36 25.8	45.7	31 10.1	54.4	14 56.1	02.0	218 14.4	16.1	288 35.2	145	17 12.4	− 108
17	77 51.3	51 28.6	45.8	46 10.8	55.1	29 58.1	02.2	233 17.0	16.0	303 08.7	146	17 01.6	− 109
18	92 53.8	66 31.4	+18 45.9	61 11.5	+12 55.7	45 00.1	+17 02.3	248 19.7	− 7 16.0	317 42.3	146	+16 50.7	− 109
19	107 56.2	81 34.2	46.0	76 12.3	56.4	60 02.0	02.4	263 22.3	15.9	332 15.9	147	16 39.8	− 110
20	122 58.7	96 37.0	46.1	91 13.0	57.0	75 04.0	02.6	278 24.9	15.8	346 49.6	148	16 28.8	− 110
21	138 01.2	111 39.8	•• 46.1	106 13.7	•• 57.6	90 06.0	•• 02.7	293 27.5	•• 15.8	1 23.4	148	•16 17.8	− 112
22	153 03.6	126 42.7	46.2	121 14.4	58.3	105 07.9	02.8	308 30.2	15.7	15 57.2	149	16 06.6	− 111
23	168 06.1	141 45.5	46.3	136 15.1	58.9	120 09.9	03.0	323 32.8	15.6	30 31.1	149	15 55.5	− 113
24	183 08.6	156 48.3	+18 46.4	151 15.9	+12 59.6	135 11.8	+17 03.1	338 35.4	− 7 15.6	45 05.0	150	+15 44.2	− 113
code	−	+ 27	+ 1	+ 7	+ 7	+ 19	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
23 0	178 17.5	+ 0 49.3
1	193 17.7	50.3
2	208 17.8	51.3
3	223 18.0	52.3
4	238 18.2	53.3
5	253 18.4	54.3
6	268 18.6	+ 0 55.3
7	283 18.8	56.2
8	298 19.0	57.2
9	313 19.2	58.2
10	328 19.4	0 59.2
11	343 19.5	1 00.2
12	358 19.7	+ 1 01.2
13	13 19.9	02.2
14	28 20.1	03.1
15	43 20.3	04.1
16	58 20.5	05.1
17	73 20.7	06.1
18	88 20.9	+ 1 07.1
19	103 21.1	08.1
20	118 21.2	09.1
21	133 21.4	10.0
22	148 21.6	11.0
23	163 21.8	12.0
24 0	178 22.0	+ 1 13.0
1	193 22.2	14.0
2	208 22.4	15.0
3	223 22.6	15.9
4	238 22.8	16.9
5	253 23.0	17.9
6	268 23.1	+ 1 18.9
7	283 23.3	19.9
8	298 23.5	20.9
9	313 23.7	21.8
10	328 23.9	22.8
11	343 24.1	23.8
12	358 24.3	+ 1 24.8
13	13 24.5	25.8
14	28 24.7	26.8
15	43 24.9	27.8
16	58 25.1	28.7
17	73 25.2	29.7
18	88 25.4	+ 1 30.7
19	103 25.6	31.7
20	118 25.8	32.7
21	133 26.0	33.7
22	148 26.2	34.6
23	163 26.4	35.6
25 0	178 26.6	+ 1 36.6
1	193 26.8	37.6
2	208 27.0	38.6
3	223 27.1	39.6
4	238 27.3	40.5
5	253 27.5	41.5
6	268 27.7	+ 1 42.5
7	283 27.9	43.5
8	298 28.1	44.5
9	313 28.3	45.4
10	328 28.5	46.4
11	343 28.7	47.4
12	358 28.9	+ 1 48.4
13	13 29.1	49.4
14	28 29.2	50.4
15	43 29.4	51.3
16	58 29.6	52.3
17	73 29.8	53.3
18	88 30.0	+ 1 54.3
19	103 30.2	55.3
20	118 30.4	56.3
21	133 30.6	57.2
22	148 30.8	58.2
23	163 31.0	1 59.2
24	178 31.2	+ 2 00.2
code	−	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.5	−62 50.6
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.6	−47 11.2
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 30.8	+28 49.9
51	Altair	62 52.4	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.6	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 03.9	−68 56.6
22	Avior	234 36.4	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.2	+ 7 24.0
17	Canopus	264 16.2	−52 40.4
12	Capella	281 41.4	+45 57.4
53	Deneb	50 02.7	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 07.1	+51 29.2
54	Enif	34 31.8	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.2
31	Gacrux	172 51.0	−56 51.2
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.8	−60 09.0
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.7	−34 24.6
40	Kochab	137 16.6	+74 20.4
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.1	−69 31.7
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.3	−26 21.5
52	Peacock	54 30.5	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.3	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.3	−60 38.7
44	Sabik	103 04.3	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.2	−37 04.3
18	Sirius	259 13.5	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.5	−43 14.8
49	Vega	81 09.6	+38 44.0
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 23	24	25
h	m s	m s	m s
0	− 6 50.5	− 6 32.4	− 6 14.1
6	− 6 46.0	− 6 27.8	− 6 09.5
12	− 6 41.4	− 6 23.2	− 6 04.9
18	− 6 36.9	− 6 18.7	− 6 00.4
24	− 6 32.4	− 6 14.1	− 5 55.8

Lat.	Sunrise	Twlt. begins	Moonrise 23	24	25	26
N °	h m	h m	h m	h m	h m	h m
72	5 39	////	▭	▭	▭	12 14
70	5 42	1 11	▭	▭	10 20	12 41
68	5 44	2 03	▭	▭	11 03	13 01
66	5 46	2 33	▭	9 29	11 32	13 17
64	5 48	2 54	8 08	10 09	11 53	13 30
62	5 49	3 11	8 58	10 36	12 11	13 40
60	5 50	3 24	9 28	10 57	12 25	13 49
58	5 51	3 35	9 52	11 14	12 37	13 57
56	5 52	3 45	10 11	11 28	12 47	14 04
54	5 53	3 53	10 26	11 41	12 56	14 11
52	5 54	4 00	10 40	11 52	13 05	14 16
50	5 55	4 06	10 52	12 01	13 12	14 21
45	5 56	4 18	11 16	12 22	13 27	14 32
40	5 58	4 28	11 36	12 38	13 40	14 41
35	5 59	4 35	11 52	12 52	13 51	14 49
30	5 59	4 41	12 06	13 04	14 00	14 55
20	6 01	4 49	12 30	13 24	14 17	15 07
10	6 02	4 53	12 51	13 42	14 31	15 17
0	6 03	4 54	13 10	13 58	14 44	15 26
10	6 04	4 54	13 29	14 15	14 57	15 36
20	6 05	4 52	13 49	14 32	15 11	15 46
30	6 06	4 45	14 13	14 52	15 27	15 57
35	6 06	4 42	14 27	15 04	15 36	16 04
40	6 07	4 36	14 43	15 17	15 46	16 11
45	6 07	4 28	15 02	15 33	15 58	16 20
50	6 08	4 17	15 25	15 52	16 13	16 30
52	6 08	4 12	15 37	16 01	16 20	16 35
54	6 08	4 07	15 50	16 12	16 28	16 40
56	6 09	4 00	16 04	16 23	16 36	16 45
58	6 09	3 53	16 22	16 36	16 46	16 52
60	6 09	3 43	16 43	16 52	16 57	16 59
S						

Lat.	Sunset	Twlt. ends	Moonset 23	24	25	26
N °	h m	h m	h m	h m	h m	h m
72	18 36	////	▭	▭	▭	6 39
70	18 33	23 21	▭	▭	7 03	6 11
68	18 31	22 21	▭	▭	6 18	5 49
66	18 29	21 49	▭	6 16	5 48	5 32
64	18 27	21 25	5 53	5 35	5 26	5 18
62	18 25	21 07	5 03	5 07	5 07	5 07
60	18 24	20 54	4 31	4 45	4 52	4 56
58	18 23	20 42	4 08	4 28	4 40	4 47
56	18 22	20 33	3 49	4 13	4 28	4 40
54	18 21	20 24	3 33	4 00	4 19	4 33
52	18 20	20 17	3 19	3 48	4 10	4 26
50	18 19	20 10	3 06	3 38	4 02	4 21
45	18 17	19 57	2 41	3 17	3 45	4 08
40	18 16	19 47	2 21	3 00	3 31	3 58
35	18 15	19 40	2 04	2 45	3 19	3 49
30	18 14	19 34	1 50	2 32	3 09	3 41
20	18 12	19 25	1 25	2 11	2 51	3 28
10	18 11	19 21	1 03	1 52	2 35	3 16
0	18 10	19 19	0 43	1 34	2 21	3 05
10	18 09	19 19	0 23	1 16	2 06	2 53
20	18 08	19 21	0 01	0 56	1 50	2 41
30	18 07	19 27	24 34	0 34	1 31	2 27
35	18 06	19 30	24 21	0 21	1 21	2 19
40	18 05	19 35	24 06	0 06	1 08	2 10
45	18 05	19 43	23 47	24 53	0 53	1 59
50	18 04	19 53	23 25	24 35	0 35	1 45
52	18 04	19 58	23 14	24 27	0 27	1 39
54	18 03	20 03	23 01	24 17	0 17	1 32
56	18 03	20 09	22 47	24 06	0 06	1 24
58	18 03	20 17	22 30	23 54	25 16	1 16
60	18 02	20 25	22 10	23 39	25 06	1 06
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
23	19 22	13 43	13 58	15 07	1 38
24	20 10	13 39	13 57	15 04	1 34
25	20 54	13 35	13 55	15 00	1 30
26	21 36	13 30	13 54	14 57	1 25

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.4	0.1
30	0.4	0.3	0.1
45	0.4	0.3	0.0
60	0.4	0.2	0.0
75	0.4	0.1	0.0
90			

Moon's Lower Limb
Add

Alt.	23	24	25
°	′	′	′
0	13.3	12.6	12.1
4	13.3	12.6	12.1
8	13.3	12.7	12.2
12	13.3	12.7	12.2
16	13.3	12.7	12.2
20	13.4	12.8	12.3
24	13.4	12.9	12.4
28	13.5	12.9	12.5
32	13.6	13.0	12.6
36	13.6	13.1	12.7
40	13.7	13.2	12.8
44	13.8	13.3	12.9
48	13.9	13.4	13.1
52	14.0	13.6	13.2
56	14.1	13.7	13.4
60	14.2	13.8	13.5
64	14.3	14.0	13.7
68	14.4	14.1	13.9
72	14.6	14.3	14.1
76	14.7	14.4	14.3
80	14.8	14.6	14.4
84	14.9	14.8	14.6
88	15.0	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	23	24	25
°	′	′	′
0	16.9	17.2	17.5
4	16.8	17.2	17.5
8	16.8	17.2	17.5
12	16.8	17.2	17.4
16	16.8	17.1	17.4
20	16.7	17.1	17.3
24	16.7	17.0	17.2
28	16.6	16.9	17.2
32	16.6	16.8	17.1
36	16.5	16.7	16.9
40	16.4	16.6	16.8
44	16.3	16.5	16.7
48	16.2	16.4	16.6
52	16.1	16.3	16.4
56	16.0	16.1	16.2
60	15.9	16.0	16.1
64	15.8	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.2	15.2
84	15.2	15.1	15.0
88	15.1	15.0	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
26 0	183 08.6	156 48.3	+18 46.4	151 15.9	+12 59.6	135 11.8	+17 03.1	338 35.4	− 7 15.6	45 05.0	150	+15 44.2	−113
1	198 11.0	171 51.1	46.5	166 16.6	13 00.2	150 13.8	03.3	353 38.0	15.5	59 39.0	150	15 32.9	−113
2	213 13.5	186 54.0	46.5	181 17.3	00.8	165 15.8	03.4	8 40.7	15.4	74 13.0	152	15 21.6	−114
3	228 16.0	201 56.8	•• 46.6	196 18.0	•• 01.5	180 17.7	•• 03.5	23 43.3	•• 15.4	88 47.2	151	•15 10.2	−115
4	243 18.4	216 59.6	46.7	211 18.7	02.1	195 19.7	03.7	38 45.9	15.3	103 21.3	153	14 58.7	−115
5	258 20.9	232 02.5	46.8	226 19.5	02.8	210 21.7	03.8	53 48.5	15.2	117 55.6	152	14 47.2	−116
6	273 23.3	247 05.3	+18 46.8	241 20.2	+13 03.4	225 23.6	+17 04.0	68 51.2	− 7 15.2	132 29.8	154	+14 35.6	−116
7	288 25.8	262 08.2	46.9	256 20.9	04.0	240 25.6	04.1	83 53.8	15.1	147 04.2	154	14 24.0	−117
8	303 28.3	277 11.0	46.9	271 21.6	04.7	255 27.5	04.2	98 56.4	15.0	161 38.6	154	14 12.3	−117
9	318 30.7	292 13.9	•• 47.0	286 22.3	•• 05.3	270 29.5	•• 04.4	113 59.0	•• 15.0	176 13.0	155	•14 00.6	−118
10	333 33.2	307 16.7	47.1	301 23.1	06.0	285 31.5	04.5	129 01.7	14.9	190 47.5	156	13 48.8	−119
11	348 35.7	322 19.6	47.1	316 23.8	06.6	300 33.4	04.7	144 04.3	14.8	205 22.1	156	13 36.9	−118
12	3 38.1	337 22.5	+18 47.2	331 24.5	+13 07.2	315 35.4	+17 04.8	159 06.9	− 7 14.8	219 56.7	156	+13 25.1	−120
13	18 40.6	352 25.4	47.2	346 25.2	07.9	330 37.4	04.9	174 09.5	14.7	234 31.3	157	13 13.1	−120
14	33 43.1	7 28.2	47.3	1 25.9	08.5	345 39.3	05.1	189 12.2	14.6	249 06.0	158	13 01.1	−120
15	48 45.5	22 31.1	•• 47.3	16 26.6	•• 09.1	0 41.3	•• 05.2	204 14.8	•• 14.6	263 40.8	157	•12 49.1	−121
16	63 48.0	37 34.0	47.4	31 27.4	09.8	15 43.2	05.4	219 17.4	14.5	278 15.5	159	12 37.0	−121
17	78 50.5	52 36.9	47.4	46 28.1	10.4	30 45.2	05.5	234 20.0	14.4	292 50.4	159	12 24.9	−122
18	93 52.9	67 39.8	+18 47.4	61 28.8	+13 11.1	45 47.2	+17 05.6	249 22.7	− 7 14.4	307 25.3	159	+12 12.7	−122
19	108 55.4	82 42.7	47.5	76 29.5	11.7	60 49.1	05.8	264 25.3	14.3	322 00.2	160	12 00.5	−122
20	123 57.8	97 45.6	47.5	91 30.2	12.3	75 51.1	05.9	279 27.9	14.2	336 35.2	160	11 48.3	−123
21	139 00.3	112 48.5	•• 47.5	106 31.0	•• 13.0	90 53.0	•• 06.1	294 30.6	•• 14.2	351 10.2	160	•11 36.0	−124
22	154 02.8	127 51.4	47.6	121 31.7	13.6	105 55.0	06.2	309 33.2	14.1	5 45.2	162	11 23.6	−123
23	169 05.2	142 54.3	47.6	136 32.4	14.2	120 57.0	06.3	324 35.8	14.0	20 20.4	161	11 11.3	−125
27 0	184 07.7	157 57.2	+18 47.6	151 33.1	+13 14.9	135 58.9	+17 06.5	339 38.4	− 7 14.0	34 55.5	162	+10 58.8	−124
1	199 10.2	173 00.2	47.6	166 33.8	15.5	151 00.9	06.6	354 41.1	13.9	49 30.7	162	10 46.4	−125
2	214 12.6	188 03.1	47.7	181 34.5	16.1	166 02.8	06.8	9 43.7	13.8	64 05.9	162	10 33.9	−126
3	229 15.1	203 06.0	•• 47.7	196 35.3	•• 16.8	181 04.8	•• 06.9	24 46.3	•• 13.7	78 41.1	163	•10 21.3	−125
4	244 17.6	218 08.9	47.7	211 36.0	17.4	196 06.8	07.0	39 48.9	13.7	93 16.4	164	10 08.8	−127
5	259 20.0	233 11.9	47.7	226 36.7	18.0	211 08.7	07.2	54 51.6	13.6	107 51.8	163	9 56.1	−126
6	274 22.5	248 14.8	+18 47.7	241 37.4	+13 18.7	226 10.7	+17 07.3	69 54.2	− 7 13.5	122 27.1	164	+ 9 43.5	−127
7	289 25.0	263 17.8	47.7	256 38.1	19.3	241 12.6	07.5	84 56.8	13.5	137 02.5	165	9 30.8	−127
8	304 27.4	278 20.7	47.7	271 38.8	19.9	256 14.6	07.6	99 59.5	13.4	151 38.0	164	9 18.1	−128
9	319 29.9	293 23.7	•• 47.7	286 39.6	•• 20.6	271 16.6	•• 07.7	115 02.1	•• 13.3	166 13.4	165	• 9 05.3	−127
10	334 32.3	308 26.6	47.7	301 40.3	21.2	286 18.5	07.9	130 04.7	13.3	180 48.9	166	8 52.6	−129
11	349 34.8	323 29.6	47.7	316 41.0	21.8	301 20.5	08.0	145 07.3	13.2	195 24.5	165	8 39.7	−128
12	4 37.3	338 32.6	+18 47.7	331 41.7	+13 22.5	316 22.4	+17 08.2	160 10.0	− 7 13.1	210 00.0	166	+ 8 26.9	−129
13	19 39.7	353 35.5	47.7	346 42.4	23.1	331 24.4	08.3	175 12.6	13.1	224 35.6	166	8 14.0	−129
14	34 42.2	8 38.5	47.7	1 43.1	23.7	346 26.4	08.4	190 15.2	13.0	239 11.2	166	8 01.1	−129
15	49 44.7	23 41.5	•• 47.7	16 43.9	•• 24.4	1 28.3	•• 08.6	205 17.8	•• 12.9	253 46.8	167	• 7 48.2	−130
16	64 47.1	38 44.5	47.7	31 44.6	25.0	16 30.3	08.7	220 20.5	12.9	268 22.5	167	7 35.2	−130
17	79 49.6	53 47.4	47.7	46 45.3	25.6	31 32.2	08.9	235 23.1	12.8	282 58.2	167	7 22.2	−130
18	94 52.1	68 50.4	+18 47.6	61 46.0	+13 26.3	46 34.2	+17 09.0	250 25.7	− 7 12.7	297 33.9	168	+ 7 09.2	−131
19	109 54.5	83 53.4	47.6	76 46.7	26.9	61 36.1	09.1	265 28.4	12.7	312 09.7	167	6 56.1	−131
20	124 57.0	98 56.4	47.6	91 47.4	27.5	76 38.1	09.3	280 31.0	12.6	326 45.4	168	6 43.0	−131
21	139 59.4	113 59.4	•• 47.6	106 48.2	•• 28.2	91 40.1	•• 09.4	295 33.6	•• 12.5	341 21.2	168	• 6 29.9	−131
22	155 01.9	129 02.4	47.5	121 48.9	28.8	106 42.0	09.6	310 36.2	12.5	355 57.0	168	6 16.8	−131
23	170 04.4	144 05.4	47.5	136 49.6	29.4	121 44.0	09.7	325 38.9	12.4	10 32.8	169	6 03.7	−132
28 0	185 06.8	159 08.4	+18 47.5	151 50.3	+13 30.1	136 45.9	+17 09.9	340 41.5	− 7 12.3	25 08.7	168	+ 5 50.5	−132
1	200 09.3	174 11.5	47.4	166 51.0	30.7	151 47.9	10.0	355 44.1	12.3	39 44.5	169	5 37.3	−132
2	215 11.8	189 14.5	47.4	181 51.7	31.3	166 49.8	10.1	10 46.8	12.2	54 20.4	169	5 24.1	−132
3	230 14.2	204 17.5	•• 47.4	196 52.5	•• 31.9	181 51.8	•• 10.3	25 49.4	•• 12.1	68 56.3	169	• 5 10.9	−133
4	245 16.7	219 20.5	47.3	211 53.2	32.6	196 53.7	10.4	40 52.0	12.0	83 32.2	169	4 57.6	−133
5	260 19.2	234 23.6	47.3	226 53.9	33.2	211 55.7	10.6	55 54.6	12.0	98 08.1	169	4 44.3	−133
6	275 21.6	249 26.6	+18 47.2	241 54.6	+13 33.8	226 57.7	+17 10.7	70 57.3	− 7 11.9	112 44.0	170	+ 4 31.0	−133
7	290 24.1	264 29.6	47.2	256 55.3	34.5	241 59.6	10.8	85 59.9	11.8	127 20.0	169	4 17.7	−133
8	305 26.6	279 32.7	47.1	271 56.0	35.1	257 01.6	11.0	101 02.5	11.8	141 55.9	170	4 04.4	−133
9	320 29.0	294 35.7	•• 47.1	286 56.7	•• 35.7	272 03.5	•• 11.1	116 05.2	•• 11.7	156 31.9	170	• 3 51.1	−134
10	335 31.5	309 38.8	47.0	301 57.5	36.3	287 05.5	11.3	131 07.8	11.6	171 07.9	170	3 37.7	−134
11	350 33.9	324 41.8	46.9	316 58.2	37.0	302 07.4	11.4	146 10.4	11.6	185 43.9	170	3 24.3	−133
12	5 36.4	339 44.9	+18 46.9	331 58.9	+13 37.6	317 09.4	+17 11.5	161 13.1	− 7 11.5	200 19.9	170	+ 3 11.0	−135
13	20 38.9	354 47.9	46.8	346 59.6	38.2	332 11.3	11.7	176 15.7	11.4	214 55.9	170	2 57.5	−134
14	35 41.3	9 51.0	46.8	2 00.3	38.9	347 13.3	11.8	191 18.3	11.4	229 31.9	170	2 44.1	−134
15	50 43.8	24 54.1	•• 46.7	17 01.0	•• 39.5	2 15.3	•• 12.0	206 20.9	•• 11.3	244 07.9	170	• 2 30.7	−134
16	65 46.3	39 57.1	46.6	32 01.7	40.1	17 17.2	12.1	221 23.6	11.2	258 43.9	170	2 17.3	−135
17	80 48.7	55 00.2	46.5	47 02.5	40.7	32 19.2	12.2	236 26.2	11.2	273 19.9	170	2 03.8	−134
18	95 51.2	70 03.3	+18 46.5	62 03.2	+13 41.4	47 21.1	+17 12.4	251 28.8	− 7 11.1	287 55.9	170	+ 1 50.4	−135
19	110 53.7	85 06.4	46.4	77 03.9	42.0	62 23.1	12.5	266 31.5	11.0	302 31.9	170	1 36.9	−135
20	125 56.1	100 09.5	46.3	92 04.6	42.6	77 25.0	12.7	281 34.1	11.0	317 07.9	170	1 23.4	−135
21	140 58.6	115 12.6	•• 46.2	107 05.3	•• 43.2	92 27.0	•• 12.8	296 36.7	•• 10.9	331 43.9	171	• 1 09.9	−134
22	156 01.0	130 15.7	46.1	122 06.0	43.9	107 28.9	12.9	311 39.3	10.8	346 20.0	170	0 56.5	−135
23	171 03.5	145 18.8	46.0	137 06.7	44.5	122 30.9	13.1	326 42.0	10.7	0 56.0	170	0 43.0	−135
24	186 06.0	160 21.9	+18 45.9	152 07.5	+13 45.1	137 32.8	+17 13.2	341 44.6	− 7 10.7	15 32.0	170	+ 0 29.5	−135
code	−	+ 29	0	+ 7	+ 6	+ 20	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
26 0h	178 31.2	+ 2 00.2
1	193 31.3	01.2
2	208 31.5	02.1
3	223 31.7	03.1
4	238 31.9	04.1
5	253 32.1	05.1
6	268 32.3	+ 2 06.1
7	283 32.5	07.0
8	298 32.7	08.0
9	313 32.9	09.0
10	328 33.1	10.0
11	343 33.3	11.0
12	358 33.4	+ 2 12.0
13	13 33.6	12.9
14	28 33.8	13.9
15	43 34.0	14.9
16	58 34.2	15.9
17	73 34.4	16.9
18	88 34.6	+ 2 17.8
19	103 34.8	18.8
20	118 35.0	19.8
21	133 35.2	20.8
22	148 35.4	21.8
23	163 35.5	22.7
27 0h	178 35.7	+ 2 23.7
1	193 35.9	24.7
2	208 36.1	25.7
3	223 36.3	26.6
4	238 36.5	27.6
5	253 36.7	28.6
6	268 36.9	+ 2 29.6
7	283 37.1	30.6
8	298 37.3	31.5
9	313 37.5	32.5
10	328 37.6	33.5
11	343 37.8	34.5
12	358 38.0	+ 2 35.5
13	13 38.2	36.4
14	28 38.4	37.4
15	43 38.6	38.4
16	58 38.8	39.4
17	73 39.0	40.3
18	88 39.2	+ 2 41.3
19	103 39.4	42.3
20	118 39.6	43.3
21	133 39.8	44.3
22	148 39.9	45.2
23	163 40.1	46.2
28 0h	178 40.3	+ 2 47.2
1	193 40.5	48.2
2	208 40.7	49.1
3	223 40.9	50.1
4	238 41.1	51.1
5	253 41.3	52.1
6	268 41.5	+ 2 53.0
7	283 41.7	54.0
8	298 41.9	55.0
9	313 42.0	56.0
10	328 42.2	57.0
11	343 42.4	57.9
12	358 42.6	+ 2 58.9
13	13 42.8	2 59.9
14	28 43.0	3 00.9
15	43 43.2	01.8
16	58 43.4	02.8
17	73 43.6	03.8
18	88 43.8	+ 3 04.8
19	103 44.0	05.7
20	118 44.1	06.7
21	133 44.3	07.7
22	148 44.5	08.7
23	163 44.7	09.6
24	178 44.9	+ 3 10.6
code	—	+ 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.6
5	Achernar	336 00.6	−57 28.5
30	Acrux	173 59.5	−62 50.6
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.6	−47 11.2
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.4	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.6	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 03.9	−68 56.6
22	Avior	234 36.4	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.2	−52 40.4
12	Capella	281 41.4	+45 57.4
53	Deneb	50 02.6	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 07.1	+51 29.2
54	Enif	34 31.7	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.2
31	Gacrux	172 51.0	−56 51.3
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.8	−60 09.0
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.7	−34 24.6
40	Kochab	137 16.5	+74 20.5
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.1	−69 31.7
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.3	−26 21.5
52	Peacock	54 30.5	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.3	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.2	−60 38.7
44	Sabik	103 04.3	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.2	−37 04.3
18	Sirius	259 13.5	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.6	−43 14.8
49	Vega	81 09.6	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 26	27	28
h	m s	m s	m s
0	− 5 55.8	− 5 37.4	− 5 19.1
6	− 5 51.2	− 5 32.8	− 5 14.5
12	− 5 46.6	− 5 28.3	− 5 09.9
18	− 5 42.0	− 5 23.7	− 5 05.3
24	− 5 37.4	− 5 19.1	− 5 00.8

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 26 h m	27 h m	28 h m	29 h m
72	5 23	////	12 14	14 24	16 20	18 13
70	5 28	////	12 41	14 36	16 23	18 08
68	5 31	1 34	13 01	14 46	16 25	18 03
66	5 35	2 12	13 17	14 54	16 27	18 00
64	5 37	2 39	13 30	15 01	16 29	17 57
62	5 39	2 58	13 40	15 06	16 30	17 54
60	5 41	3 12	13 49	15 11	16 32	17 52
58	5 43	3 25	13 57	15 16	16 33	17 50
56	5 45	3 35	14 04	15 20	16 34	17 48
54	5 46	3 44	14 11	15 23	16 35	17 47
52	5 47	3 51	14 16	15 26	16 36	17 45
50	5 48	3 58	14 21	15 29	16 36	17 44
45	5 51	4 13	14 32	15 35	16 38	17 41
40	5 53	4 22	14 41	15 41	16 39	17 38
35	5 54	4 31	14 49	15 45	16 41	17 36
30	5 56	4 37	14 55	15 49	16 42	17 35
20	5 58	4 45	15 07	15 56	16 44	17 31
10	6 00	4 51	15 17	16 02	16 45	17 29
0	6 02	4 54	15 26	16 07	16 47	17 26
10	6 04	4 54	15 36	16 13	16 48	17 24
20	6 06	4 52	15 46	16 18	16 50	17 21
30	6 07	4 48	15 57	16 25	16 52	17 18
35	6 09	4 44	16 04	16 29	16 53	17 17
40	6 10	4 39	16 11	16 33	16 54	17 15
45	6 11	4 32	16 20	16 38	16 55	17 12
50	6 12	4 23	16 30	16 44	16 57	17 10
52	6 13	4 18	16 35	16 47	16 58	17 09
54	6 14	4 13	16 40	16 50	16 59	17 07
56	6 15	4 07	16 45	16 53	17 00	17 06
58	6 15	4 00	16 52	16 57	17 01	17 04
60	6 16	3 52	16 59	17 01	17 02	17 03

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 26 h m	27 h m	28 h m	29 h m
72	18 50	////	6 39	5 56	5 25	4 57
70	18 46	////	6 11	5 42	5 19	4 58
68	18 42	22 51	5 49	5 30	5 14	4 59
66	18 38	22 07	5 32	5 20	5 09	4 59
64	18 36	21 41	5 18	5 12	5 06	5 00
62	18 33	21 20	5 07	5 05	5 03	5 00
60	18 31	21 04	4 56	4 58	5 00	5 01
58	18 29	20 51	4 47	4 53	4 57	5 01
56	18 28	20 40	4 40	4 48	4 55	5 01
54	18 26	20 31	4 33	4 44	4 53	5 02
52	18 25	20 23	4 26	4 40	4 51	5 02
50	18 24	20 16	4 21	4 36	4 49	5 02
45	18 21	20 02	4 08	4 28	4 46	5 03
40	18 19	19 51	3 58	4 21	4 43	5 03
35	18 17	19 42	3 49	4 16	4 40	5 04
30	18 16	19 36	3 41	4 10	4 38	5 04
20	18 13	19 27	3 28	4 01	4 33	5 05
10	18 11	19 21	3 16	3 54	4 30	5 05
0	18 09	19 18	3 05	3 46	4 26	5 06
10	18 07	19 17	2 53	3 39	4 23	5 06
20	18 05	19 18	2 41	3 31	4 19	5 07
30	18 03	19 22	2 27	3 21	4 14	5 07
35	18 02	19 26	2 19	3 16	4 12	5 08
40	18 01	19 31	2 10	3 10	4 09	5 08
45	17 59	19 37	1 59	3 03	4 06	5 08
50	17 58	19 46	1 45	2 54	4 02	5 09
52	17 57	19 50	1 39	2 50	4 00	5 09
54	17 56	19 55	1 32	2 46	3 58	5 09
56	17 55	20 00	1 24	2 41	3 55	5 09
58	17 54	20 07	1 16	2 35	3 53	5 10
60	17 53	20 15	1 06	2 29	3 50	5 10

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
26	21 36	13 30	13 54	14 57	1 25
27	22 17	13 26	13 53	14 54	1 21
28	22 56	13 21	13 52	14 51	1 17
29	23 36	13 16	13 51	14 48	1 13

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.4	0.4	0.1
30	0.4	0.4	0.1
45	0.4	0.3	0.0
60	0.4	0.2	0.0
75	0.4	0.1	0.0
90			

Moon's Lower Limb Add

Alt. °	26 ′	27 ′	28 ′
0	11.9	11.7	11.7
4	11.9	11.7	11.7
8	11.9	11.8	11.8
12	11.9	11.8	11.8
16	12.0	11.9	11.9
20	12.1	12.0	12.0
24	12.2	12.0	12.0
28	12.2	12.1	12.1
32	12.4	12.2	12.2
36	12.5	12.4	12.4
40	12.6	12.5	12.5
44	12.7	12.6	12.6
48	12.9	12.8	12.8
52	13.1	13.0	13.0
56	13.2	13.1	13.1
60	13.4	13.3	13.3
64	13.6	13.5	13.5
68	13.8	13.7	13.7
72	14.0	13.9	13.9
76	14.2	14.1	14.1
80	14.4	14.3	14.3
84	14.6	14.5	14.5
88	14.7	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	26 ′	27 ′	28 ′
0	17.7	17.7	17.7
4	17.6	17.7	17.7
8	17.6	17.7	17.7
12	17.6	17.6	17.6
16	17.5	17.6	17.6
20	17.5	17.5	17.5
24	17.4	17.4	17.4
28	17.3	17.3	17.3
32	17.2	17.2	17.2
36	17.0	17.1	17.1
40	16.9	17.0	17.0
44	16.8	16.8	16.8
48	16.6	16.7	16.7
52	16.5	16.5	16.5
56	16.3	16.3	16.3
60	16.1	16.1	16.1
64	15.9	16.0	16.0
68	15.8	15.8	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	14.9	14.9
88	14.8	14.8	14.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
29 0	186 06.0	160 21.9	+18 45.9	152 07.5	+13 45.1	137 32.8	+17 13.2	341 44.6	− 7 10.7	15 32.0	170	+ 0 29.5	−135
1	201 08.4	175 25.0	45.8	167 08.2	45.7	152 34.8	13.4	356 47.2	10.6	30 08.0	170	0 16.0	−136
2	216 10.9	190 28.1	45.7	182 08.9	46.4	167 36.7	13.5	11 49.9	10.5	44 44.0	170	+ 0 02.4	−135
3	231 13.4	205 31.2	•• 45.6	197 09.6	•• 47.0	182 38.7	•• 13.6	26 52.5	•• 10.5	59 20.0	169	− 0 11.1	−135
4	246 15.8	220 34.3	45.5	212 10.3	47.6	197 40.6	13.8	41 55.1	10.4	73 55.9	170	0 24.6	−135
5	261 18.3	235 37.4	45.4	227 11.0	48.2	212 42.6	13.9	56 57.8	10.3	88 31.9	170	0 38.1	−135
6	276 20.8	250 40.6	+18 45.3	242 11.7	+13 48.8	227 44.6	+17 14.1	72 00.4	− 7 10.3	103 07.9	169	− 0 51.6	−135
7	291 23.2	265 43.7	45.2	257 12.5	49.5	242 46.5	14.2	87 03.0	10.2	117 43.8	170	1 05.1	−135
8	306 25.7	280 46.8	45.1	272 13.2	50.1	257 48.5	14.3	102 05.7	10.1	132 19.8	169	1 18.6	−136
9	321 28.2	295 50.0	•• 45.0	287 13.9	•• 50.7	272 50.4	•• 14.5	117 08.3	•• 10.1	146 55.7	169	• 1 32.2	−135
10	336 30.6	310 53.1	44.9	302 14.6	51.3	287 52.4	14.6	132 10.9	10.0	161 31.6	169	1 45.7	−135
11	351 33.1	325 56.3	44.7	317 15.3	52.0	302 54.3	14.8	147 13.5	09.9	176 07.5	169	1 59.2	−135
12	6 35.5	340 59.4	+18 44.6	332 16.0	+13 52.6	317 56.3	+17 14.9	162 16.2	− 7 09.9	190 43.4	169	− 2 12.7	−135
13	21 38.0	356 02.6	44.5	347 16.7	53.2	332 58.2	15.0	177 18.8	09.8	205 19.3	168	2 26.2	−135
14	36 40.5	11 05.7	44.4	2 17.4	53.8	348 00.2	15.2	192 21.4	09.7	219 55.1	169	2 39.7	−135
15	51 42.9	26 08.9	•• 44.2	17 18.2	•• 54.4	3 02.1	•• 15.3	207 24.1	•• 09.6	234 31.0	168	• 2 53.2	−135
16	66 45.4	41 12.0	44.1	32 18.9	55.1	18 04.1	15.5	222 26.7	09.6	249 06.8	168	3 06.7	−135
17	81 47.9	56 15.2	44.0	47 19.6	55.7	33 06.0	15.6	237 29.3	09.5	263 42.6	168	3 20.2	−134
18	96 50.3	71 18.4	+18 43.8	62 20.3	+13 56.3	48 08.0	+17 15.7	252 32.0	− 7 09.4	278 18.4	167	− 3 33.6	−135
19	111 52.8	86 21.5	43.7	77 21.0	56.9	63 09.9	15.9	267 34.6	09.4	292 54.1	167	3 47.1	−134
20	126 55.3	101 24.7	43.6	92 21.7	57.5	78 11.9	16.0	282 37.2	09.3	307 29.8	168	4 00.5	−135
21	141 57.7	116 27.9	•• 43.4	107 22.4	•• 58.2	93 13.8	•• 16.2	297 39.9	•• 09.2	322 05.6	166	• 4 14.0	−134
22	157 00.2	131 31.1	43.3	122 23.1	58.8	108 15.8	16.3	312 42.5	09.2	336 41.2	167	4 27.4	−134
23	172 02.7	146 34.3	43.1	137 23.9	13 59.4	123 17.7	16.5	327 45.1	09.1	351 16.9	166	4 40.8	−134
30 0	187 05.1	161 37.5	+18 43.0	152 24.6	+14 00.0	138 19.7	+17 16.6	342 47.8	− 7 09.0	5 52.5	166	− 4 54.2	−134
1	202 07.6	176 40.7	42.8	167 25.3	00.6	153 21.6	16.7	357 50.4	09.0	20 28.1	165	5 07.6	−134
2	217 10.0	191 43.9	42.6	182 26.0	01.2	168 23.6	16.9	12 53.0	08.9	35 03.7	166	5 21.0	−134
3	232 12.5	206 47.1	•• 42.5	197 26.7	•• 01.9	183 25.5	•• 17.0	27 55.7	•• 08.8	49 39.3	165	• 5 34.4	−133
4	247 15.0	221 50.3	42.3	212 27.4	02.5	198 27.5	17.2	42 58.3	08.8	64 14.8	165	5 47.7	−133
5	262 17.4	236 53.5	42.1	227 28.1	03.1	213 29.4	17.3	58 00.9	08.7	78 50.3	164	6 01.0	−133
6	277 19.9	251 56.7	+18 42.0	242 28.8	+14 03.7	228 31.4	+17 17.4	73 03.5	− 7 08.6	93 25.7	164	− 6 14.3	−133
7	292 22.4	266 59.9	41.8	257 29.6	04.3	243 33.3	17.6	88 06.2	08.5	108 01.1	164	6 27.6	−133
8	307 24.8	282 03.1	41.6	272 30.3	05.0	258 35.3	17.7	103 08.8	08.5	122 36.5	164	6 40.9	−133
9	322 27.3	297 06.4	•• 41.5	287 31.0	•• 05.6	273 37.2	•• 17.9	118 11.4	•• 08.4	137 11.9	163	• 6 54.2	−132
10	337 29.8	312 09.6	41.3	302 31.7	06.2	288 39.2	18.0	133 14.1	08.3	151 47.2	163	7 07.4	−132
11	352 32.2	327 12.8	41.1	317 32.4	06.8	303 41.1	18.1	148 16.7	08.3	166 22.5	162	7 20.6	−132
12	7 34.7	342 16.1	+18 40.9	332 33.1	+14 07.4	318 43.1	+17 18.3	163 19.3	− 7 08.2	180 57.7	162	− 7 33.8	−132
13	22 37.1	357 19.3	40.7	347 33.8	08.0	333 45.0	18.4	178 22.0	08.1	195 32.9	162	7 47.0	−131
14	37 39.6	12 22.6	40.5	2 34.5	08.6	348 47.0	18.6	193 24.6	08.1	210 08.1	161	8 00.1	−131
15	52 42.1	27 25.8	•• 40.3	17 35.2	•• 09.3	3 48.9	•• 18.7	208 27.2	•• 08.0	224 43.2	161	• 8 13.2	−131
16	67 44.5	42 29.1	40.2	32 36.0	09.9	18 50.8	18.8	223 29.9	07.9	239 18.3	161	8 26.3	−131
17	82 47.0	57 32.3	40.0	47 36.7	10.5	33 52.8	19.0	238 32.5	07.9	253 53.4	160	8 39.4	−130
18	97 49.5	72 35.6	+18 39.8	62 37.4	+14 11.1	48 54.7	+17 19.1	253 35.1	− 7 07.8	268 28.4	159	− 8 52.4	−130
19	112 51.9	87 38.8	39.6	77 38.1	11.7	63 56.7	19.3	268 37.8	07.7	283 03.3	159	9 05.4	−130
20	127 54.4	102 42.1	39.4	92 38.8	12.3	78 58.6	19.4	283 40.4	07.6	297 38.2	159	9 18.4	−129
21	142 56.9	117 45.4	•• 39.1	107 39.5	•• 12.9	94 00.6	•• 19.5	298 43.0	•• 07.6	312 13.1	158	• 9 31.3	−129
22	157 59.3	132 48.6	38.9	122 40.2	13.6	109 02.5	19.7	313 45.7	07.5	326 47.9	158	9 44.2	−129
23	173 01.8	147 51.9	38.7	137 40.9	14.2	124 04.5	19.8	328 48.3	07.4	341 22.7	157	9 57.1	−129
31 0	188 04.3	162 55.2	+18 38.5	152 41.6	+14 14.8	139 06.4	+17 20.0	343 50.9	− 7 07.4	355 57.4	157	−10 10.0	−128
1	203 06.7	177 58.5	38.3	167 42.4	15.4	154 08.4	20.1	358 53.6	07.3	10 32.1	156	10 22.8	−128
2	218 09.2	193 01.8	38.1	182 43.1	16.0	169 10.3	20.3	13 56.2	07.2	25 06.7	156	10 35.6	−127
3	233 11.6	208 05.1	•• 37.8	197 43.8	•• 16.6	184 12.3	•• 20.4	28 58.8	•• 07.2	39 41.3	155	•10 48.3	−127
4	248 14.1	223 08.4	37.6	212 44.5	17.2	199 14.2	20.5	44 01.5	07.1	54 15.8	155	11 01.0	−127
5	263 16.6	238 11.7	37.4	227 45.2	17.8	214 16.2	20.7	59 04.1	07.0	68 50.3	154	11 13.7	−126
6	278 19.0	253 15.0	+18 37.2	242 45.9	+14 18.5	229 18.1	+17 20.8	74 06.7	− 7 07.0	83 24.7	154	−11 26.3	−126
7	293 21.5	268 18.3	36.9	257 46.6	19.1	244 20.0	21.0	89 09.4	06.9	97 59.1	153	11 38.9	−126
8	308 24.0	283 21.6	36.7	272 47.3	19.7	259 22.0	21.1	104 12.0	06.8	112 33.4	153	11 51.5	−125
9	323 26.4	298 24.9	•• 36.5	287 48.0	•• 20.3	274 23.9	•• 21.2	119 14.6	•• 06.7	127 07.7	151	•12 04.0	−124
10	338 28.9	313 28.2	36.2	302 48.7	20.9	289 25.9	21.4	134 17.3	06.7	141 41.8	152	12 16.4	−125
11	353 31.4	328 31.5	36.0	317 49.4	21.5	304 27.8	21.5	149 19.9	06.6	156 16.0	151	12 28.9	−123
12	8 33.8	343 34.8	+18 35.7	332 50.2	+14 22.1	319 29.8	+17 21.7	164 22.5	− 7 06.5	170 50.1	150	−12 41.2	−124
13	23 36.3	358 38.2	35.5	347 50.9	22.7	334 31.7	21.8	179 25.2	06.5	185 24.1	150	12 53.6	−123
14	38 38.7	13 41.5	35.2	2 51.6	23.3	349 33.7	21.9	194 27.8	06.4	199 58.1	149	13 05.9	−122
15	53 41.2	28 44.8	•• 35.0	17 52.3	•• 23.9	4 35.6	•• 22.1	209 30.4	•• 06.3	214 32.0	148	•13 18.1	−122
16	68 43.7	43 48.2	34.7	32 53.0	24.6	19 37.5	22.2	224 33.1	06.3	229 05.8	148	13 30.3	−122
17	83 46.1	58 51.5	34.5	47 53.7	25.2	34 39.5	22.4	239 35.7	06.2	243 39.6	147	13 42.5	−121
18	98 48.6	73 54.8	+18 34.2	62 54.4	+14 25.8	49 41.4	+17 22.5	254 38.3	− 7 06.1	258 13.3	146	−13 54.6	−120
19	113 51.1	88 58.2	33.9	77 55.1	26.4	64 43.4	22.6	269 41.0	06.0	272 46.9	146	14 06.6	−120
20	128 53.5	104 01.5	33.7	92 55.8	27.0	79 45.3	22.8	284 43.6	06.0	287 20.5	146	14 18.6	−119
21	143 56.0	119 04.9	•• 33.4	107 56.5	•• 27.6	94 47.3	•• 22.9	299 46.3	•• 05.9	301 54.1	144	•14 30.5	−119
22	158 58.5	134 08.2	33.1	122 57.2	28.2	109 49.2	23.1	314 48.9	05.8	316 27.5	144	14 42.4	−118
23	174 00.9	149 11.6	32.9	137 58.0	28.8	124 51.2	23.2	329 51.5	05.8	331 00.9	143	14 54.2	−118
24	189 03.4	164 15.0	+18 32.6	152 58.7	+14 29.4	139 53.1	+17 23.4	344 54.2	− 7 05.7	345 34.2	143	−15 06.0	−117
code	−	+ 32	− 2	+ 7	+ 6	+ 19	+ 1	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
29 h 0	178 44.9	+ 3 10.6
1	193 45.1	11.6
2	208 45.3	12.6
3	223 45.5	13.5
4	238 45.7	14.5
5	253 45.9	15.5
6	268 46.1	+ 3 16.5
7	283 46.2	17.4
8	298 46.4	18.4
9	313 46.6	19.4
10	328 46.8	20.4
11	343 47.0	21.3
12	358 47.2	+ 3 22.3
13	13 47.4	23.3
14	28 47.6	24.2
15	43 47.8	25.2
16	58 48.0	26.2
17	73 48.2	27.2
18	88 48.3	+ 3 28.1
19	103 48.5	29.1
20	118 48.7	30.1
21	133 48.9	31.1
22	148 49.1	32.0
23	163 49.3	33.0
30 0	178 49.5	+ 3 34.0
1	193 49.7	34.9
2	208 49.9	35.9
3	223 50.1	36.9
4	238 50.2	37.9
5	253 50.4	38.8
6	268 50.6	+ 3 39.8
7	283 50.8	40.8
8	298 51.0	41.7
9	313 51.2	42.7
10	328 51.4	43.7
11	343 51.6	44.7
12	358 51.8	+ 3 45.6
13	13 52.0	46.6
14	28 52.1	47.6
15	43 52.3	48.5
16	58 52.5	49.5
17	73 52.7	50.5
18	88 52.9	+ 3 51.5
19	103 53.1	52.4
20	118 53.3	53.4
21	133 53.5	54.4
22	148 53.7	55.3
23	163 53.9	56.3
31 0	178 54.0	+ 3 57.3
1	193 54.2	58.2
2	208 54.4	3 59.2
3	223 54.6	4 00.2
4	238 54.8	01.1
5	253 55.0	02.1
6	268 55.2	+ 4 03.1
7	283 55.4	04.0
8	298 55.6	05.0
9	313 55.8	06.0
10	328 55.9	07.0
11	343 56.1	07.9
12	358 56.3	+ 4 08.9
13	13 56.5	09.9
14	28 56.7	10.8
15	43 56.9	11.8
16	58 57.1	12.8
17	73 57.3	13.7
18	88 57.5	+ 4 14.7
19	103 57.6	15.7
20	118 57.8	16.6
21	133 58.0	17.6
22	148 58.2	18.6
23	163 58.4	19.5
24	178 58.6	+ 4 20.5
code	—	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.6
5	Achernar	336 00.6	−57 28.4
30	Acrux	173 59.5	−62 50.6
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.6	−47 11.2
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.4	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 03.8	−68 56.6
22	Avior	234 36.4	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.3	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.6	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 07.0	+51 29.2
54	Enif	34 31.7	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.2
31	Gacrux	172 51.0	−56 51.3
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.7	−60 09.0
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.7	−34 24.6
40	Kochab	137 16.5	+74 20.5
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.2	−69 31.7
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.3	−26 21.5
52	Peacock	54 30.4	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.3	+12 35.2
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.2	−60 38.8
44	Sabik	103 04.3	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.2	−37 04.3
18	Sirius	259 13.5	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.6	−43 14.8
49	Vega	81 09.6	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 29	30	31
h	m s	m s	m s
0	− 5 00.8	− 4 42.5	− 4 24.2
6	− 4 56.2	− 4 37.9	− 4 19.6
12	− 4 51.6	− 4 33.3	− 4 15.1
18	− 4 47.0	− 4 28.8	− 4 10.6
24	− 4 42.5	− 4 24.2	− 4 06.0

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 29 h m	30 h m	31 h m	1 h m
72	5 08	////	18 13	20 13	22 36	■
70	5 14	////	18 08	19 58	22 01	25 09
68	5 19	0 51	18 03	19 45	21 36	23 48
66	5 23	1 50	18 00	19 35	21 17	23 10
64	5 27	2 20	17 57	19 27	21 02	22 44
62	5 30	2 43	17 54	19 20	20 49	22 24
60	5 32	3 00	17 52	19 14	20 39	22 08
58	5 35	3 13	17 50	19 08	20 29	21 54
56	5 37	3 25	17 48	19 04	20 21	21 42
54	5 39	3 35	17 47	18 59	20 14	21 32
52	5 40	3 44	17 45	18 55	20 08	21 23
50	5 42	3 51	17 44	18 52	20 02	21 14
45	5 45	4 06	17 41	18 45	19 50	20 57
40	5 48	4 17	17 38	18 38	19 40	20 43
35	5 50	4 26	17 36	18 33	19 31	20 31
30	5 52	4 32	17 35	18 28	19 24	20 21
20	5 56	4 43	17 31	18 20	19 11	20 03
10	5 59	4 49	17 29	18 13	18 59	19 48
0	6 01	4 53	17 26	18 07	18 49	19 34
10	6 04	4 54	17 24	18 00	18 39	19 20
20	6 06	4 53	17 21	17 53	18 28	19 05
30	6 09	4 50	17 18	17 46	18 15	18 48
35	6 11	4 46	17 17	17 41	18 08	18 38
40	6 13	4 42	17 15	17 36	18 00	18 27
45	6 15	4 36	17 12	17 30	17 50	18 14
50	6 17	4 28	17 10	17 24	17 39	17 58
52	6 18	4 24	17 09	17 20	17 34	17 50
54	6 19	4 19	17 07	17 17	17 28	17 42
56	6 21	4 14	17 06	17 13	17 21	17 33
58	6 22	4 08	17 04	17 09	17 14	17 22
60 S	6 24	4 00	17 03	17 04	17 06	17 10

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 29 h m	30 h m	31 h m	1 h m
72	19 04	////	4 57	4 28	3 54	3 01
70	18 58	////	4 58	4 37	4 12	3 38
68	18 53	23 48	4 59	4 43	4 26	4 04
66	18 48	22 31	4 59	4 49	4 38	4 25
64	18 44	21 56	5 00	4 54	4 48	4 41
62	18 41	21 33	5 00	4 58	4 56	4 54
60	18 38	21 15	5 01	5 02	5 03	5 06
58	18 36	21 01	5 01	5 05	5 10	5 16
56	18 34	20 49	5 01	5 08	5 16	5 25
54	18 32	20 39	5 02	5 11	5 21	5 33
52	18 30	20 29	5 02	5 13	5 25	5 40
50	18 28	20 21	5 02	5 15	5 30	5 46
45	18 25	20 06	5 03	5 20	5 39	6 00
40	18 22	19 55	5 03	5 24	5 47	6 12
35	18 20	19 46	5 04	5 28	5 53	6 21
30	18 17	19 38	5 04	5 31	5 59	6 30
20	18 14	19 28	5 05	5 36	6 09	6 45
10	18 11	19 21	5 05	5 41	6 18	6 58
0	18 08	19 17	5 06	5 46	6 27	7 10
10	18 05	19 15	5 06	5 50	6 35	7 23
20	18 02	19 15	5 07	5 55	6 44	7 36
30	17 59	19 18	5 07	6 00	6 55	7 51
35	17 58	19 22	5 08	6 04	7 01	8 00
40	17 56	19 26	5 08	6 07	7 08	8 10
45	17 54	19 32	5 08	6 11	7 16	8 22
50	17 51	19 39	5 09	6 16	7 26	8 37
52	17 50	19 43	5 09	6 19	7 30	8 43
54	17 49	19 47	5 09	6 21	7 35	8 51
56	17 47	19 52	5 09	6 24	7 41	9 00
58	17 46	19 58	5 10	6 27	7 47	9 09
60 S	17 44	20 05	5 10	6 31	7 54	9 20

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
29	23 36	13 16	13 51	14 48	1 13
30	24 17	13 11	13 50	14 45	1 09
31	0 17	13 06	13 49	14 42	1 04
1	1 00	13 00	13 47	14 39	1 00

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.3	0.5	0.1
30	0.3	0.4	0.1
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb Add

Alt. °	29 ′	30 ′	31 ′
0	12.0	12.2	12.5
4	12.0	12.3	12.5
8	12.0	12.3	12.5
12	12.1	12.3	12.6
16	12.1	12.4	12.6
20	12.2	12.4	12.7
24	12.3	12.5	12.7
28	12.4	12.6	12.8
32	12.5	12.7	12.9
36	12.6	12.8	13.0
40	12.7	12.9	13.1
44	12.8	13.0	13.2
48	13.0	13.2	13.4
52	13.1	13.3	13.5
56	13.3	13.5	13.6
60	13.5	13.6	13.8
64	13.6	13.8	13.9
68	13.8	14.0	14.1
72	14.0	14.1	14.2
76	14.2	14.3	14.4
80	14.4	14.5	14.6
84	14.6	14.7	14.7
88	14.7	14.8	14.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	29 ′	30 ′	31 ′
0	17.6	17.4	17.3
4	17.6	17.4	17.3
8	17.5	17.4	17.3
12	17.5	17.4	17.2
16	17.5	17.3	17.2
20	17.4	17.3	17.1
24	17.3	17.2	17.1
28	17.2	17.1	17.0
32	17.1	17.0	16.9
36	17.0	16.9	16.8
40	16.9	16.8	16.7
44	16.7	16.6	16.6
48	16.6	16.5	16.4
52	16.4	16.4	16.3
56	16.3	16.2	16.2
60	16.1	16.1	16.0
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.1
88	14.8	14.9	14.9
90			

Subtract from table, back cover

Palm Sunday	29
Full Moon	30
First Day of Passover	31

GMT	♈ GHA	VENUS −3.8 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
1 0	189 03.4	164 15.0	+18 32.6	152 58.7	+14 29.4	139 53.1	+17 23.4	344 54.2	− 7 05.7	345 34.2	143	−15 06.0	117
1	204 05.9	179 18.3	32.3	167 59.4	30.0	154 55.0	23.5	359 56.8	05.6	0 07.5	142	15 17.7	117
2	219 08.3	194 21.7	32.0	183 00.1	30.6	169 57.0	23.6	14 59.4	05.6	14 40.7	141	15 29.4	116
3	234 10.8	209 25.1	•• 31.7	198 00.8	•• 31.2	184 58.9	•• 23.8	30 02.1	•• 05.5	29 13.8	140	•15 41.0	115
4	249 13.2	224 28.4	31.4	213 01.5	31.8	200 00.9	23.9	45 04.7	05.4	43 46.8	140	15 52.5	115
5	264 15.7	239 31.8	31.2	228 02.2	32.4	215 02.8	24.1	60 07.3	05.4	58 19.8	139	16 04.0	114
6	279 18.2	254 35.2	+18 30.9	243 02.9	+14 33.0	230 04.8	+17 24.2	75 10.0	− 7 05.3	72 52.7	138	−16 15.4	114
7	294 20.6	269 38.6	30.6	258 03.6	33.7	245 06.7	24.3	90 12.6	05.2	87 25.5	138	16 26.8	113
8	309 23.1	284 42.0	30.3	273 04.3	34.3	260 08.6	24.5	105 15.2	05.1	101 58.3	137	16 38.1	112
9	324 25.6	299 45.4	•• 30.0	288 05.0	•• 34.9	275 10.6	•• 24.6	120 17.9	•• 05.1	116 31.0	136	•16 49.3	112
10	339 28.0	314 48.8	29.7	303 05.7	35.5	290 12.5	24.8	135 20.5	05.0	131 03.6	135	17 00.5	111
11	354 30.5	329 52.2	29.4	318 06.4	36.1	305 14.5	24.9	150 23.1	04.9	145 36.1	135	17 11.6	110
12	9 33.0	344 55.6	+18 29.1	333 07.2	+14 36.7	320 16.4	+17 25.0	165 25.8	− 7 04.9	160 08.6	133	−17 22.6	110
13	24 35.4	359 59.0	28.7	348 07.9	37.3	335 18.3	25.2	180 28.4	04.8	174 40.9	134	17 33.6	108
14	39 37.9	15 02.4	28.4	3 08.6	37.9	350 20.3	25.3	195 31.0	04.7	189 13.3	132	17 44.4	109
15	54 40.4	30 05.8	•• 28.1	18 09.3	•• 38.5	5 22.2	•• 25.5	210 33.7	•• 04.7	203 45.5	131	•17 55.3	107
16	69 42.8	45 09.2	27.8	33 10.0	39.1	20 24.2	25.6	225 36.3	04.6	218 17.6	131	18 06.0	107
17	84 45.3	60 12.6	27.5	48 10.7	39.7	35 26.1	25.7	240 39.0	04.5	232 49.7	130	18 16.7	106
18	99 47.7	75 16.1	+18 27.1	63 11.4	+14 40.3	50 28.1	+17 25.9	255 41.6	− 7 04.4	247 21.7	129	−18 27.3	105
19	114 50.2	90 19.5	26.8	78 12.1	40.9	65 30.0	26.0	270 44.2	04.4	261 53.6	128	18 37.8	104
20	129 52.7	105 22.9	26.5	93 12.8	41.5	80 31.9	26.2	285 46.9	04.3	276 25.4	128	18 48.2	104
21	144 55.1	120 26.4	•• 26.2	108 13.5	•• 42.1	95 33.9	•• 26.3	300 49.5	•• 04.2	290 57.2	127	•18 58.6	103
22	159 57.6	135 29.8	25.8	123 14.2	42.7	110 35.8	26.5	315 52.1	04.2	305 28.9	126	19 08.9	102
23	175 00.1	150 33.2	25.5	138 14.9	43.3	125 37.8	26.6	330 54.8	04.1	320 00.5	125	19 19.1	101
2 0	190 02.5	165 36.7	+18 25.2	153 15.6	+14 43.9	140 39.7	+17 26.7	345 57.4	− 7 04.0	334 32.0	124	−19 29.2	100
1	205 05.0	180 40.1	24.8	168 16.3	44.5	155 41.6	26.9	1 00.0	04.0	349 03.4	124	19 39.2	100
2	220 07.5	195 43.6	24.5	183 17.1	45.1	170 43.6	27.0	16 02.7	03.9	3 34.8	122	19 49.2	98
3	235 09.9	210 47.0	•• 24.1	198 17.8	•• 45.7	185 45.5	•• 27.2	31 05.3	•• 03.8	18 06.0	122	•19 59.0	98
4	250 12.4	225 50.5	23.8	213 18.5	46.3	200 47.5	27.3	46 07.9	03.7	32 37.2	121	20 08.8	97
5	265 14.8	240 53.9	23.4	228 19.2	46.9	215 49.4	27.4	61 10.6	03.7	47 08.3	120	20 18.5	96
6	280 17.3	255 57.4	+18 23.1	243 19.9	+14 47.5	230 51.3	+17 27.6	76 13.2	− 7 03.6	61 39.3	119	−20 28.1	96
7	295 19.8	271 00.8	22.7	258 20.6	48.1	245 53.3	27.7	91 15.9	03.5	76 10.2	119	20 37.7	94
8	310 22.2	286 04.3	22.3	273 21.3	48.7	260 55.2	27.9	106 18.5	03.5	90 41.1	117	20 47.1	93
9	325 24.7	301 07.8	•• 22.0	288 22.0	•• 49.3	275 57.2	•• 28.0	121 21.1	•• 03.4	105 11.8	117	•20 56.4	93
10	340 27.2	316 11.3	21.6	303 22.7	49.9	290 59.1	28.1	136 23.8	03.3	119 42.5	116	21 05.7	91
11	355 29.6	331 14.7	21.2	318 23.4	50.5	306 01.0	28.3	151 26.4	03.3	134 13.1	115	21 14.8	91
12	10 32.1	346 18.2	+18 20.9	333 24.1	+14 51.1	321 03.0	+17 28.4	166 29.0	− 7 03.2	148 43.6	114	−21 23.9	89
13	25 34.6	1 21.7	20.5	348 24.8	51.7	336 04.9	28.6	181 31.7	03.1	163 14.0	114	21 32.8	89
14	40 37.0	16 25.2	20.1	3 25.5	52.3	351 06.8	28.7	196 34.3	03.0	177 44.4	112	21 41.7	88
15	55 39.5	31 28.7	•• 19.7	18 26.2	•• 52.9	6 08.8	•• 28.8	211 36.9	•• 03.0	192 14.6	112	•21 50.5	86
16	70 42.0	46 32.2	19.4	33 26.9	53.5	21 10.7	29.0	226 39.6	02.9	206 44.8	111	21 59.1	86
17	85 44.4	61 35.6	19.0	48 27.6	54.1	36 12.7	29.1	241 42.2	02.8	221 14.9	110	22 07.7	85
18	100 46.9	76 39.1	+18 18.6	63 28.3	+14 54.7	51 14.6	+17 29.3	256 44.9	− 7 02.8	235 44.9	109	−22 16.2	83
19	115 49.3	91 42.6	18.2	78 29.0	55.3	66 16.5	29.4	271 47.5	02.7	250 14.8	108	22 24.5	83
20	130 51.8	106 46.2	17.8	93 29.8	55.9	81 18.5	29.6	286 50.1	02.6	264 44.6	107	22 32.8	81
21	145 54.3	121 49.7	•• 17.4	108 30.5	•• 56.5	96 20.4	•• 29.7	301 52.8	•• 02.6	279 14.3	107	•22 40.9	81
22	160 56.7	136 53.2	17.0	123 31.2	57.1	111 22.3	29.8	316 55.4	02.5	293 44.0	106	22 49.0	79
23	175 59.2	151 56.7	16.6	138 31.9	57.6	126 24.3	30.0	331 58.0	02.4	308 13.6	104	22 56.9	78
3 0	191 01.7	167 00.2	+18 16.2	153 32.6	+14 58.2	141 26.2	+17 30.1	347 00.7	− 7 02.3	322 43.0	104	−23 04.7	77
1	206 04.1	182 03.7	15.8	168 33.3	58.8	156 28.2	30.3	2 03.3	02.3	337 12.4	103	23 12.4	77
2	221 06.6	197 07.2	15.4	183 34.0	14 59.4	171 30.1	30.4	17 06.0	02.2	351 41.7	103	23 20.1	75
3	236 09.1	212 10.8	•• 15.0	198 34.7	•15 00.0	186 32.0	•• 30.5	32 08.6	•• 02.1	6 11.0	101	•23 27.6	73
4	251 11.5	227 14.3	14.6	213 35.4	00.6	201 34.0	30.7	47 11.2	02.1	20 40.1	101	23 34.9	73
5	266 14.0	242 17.8	14.2	228 36.1	01.2	216 35.9	30.8	62 13.9	02.0	35 09.2	99	23 42.2	72
6	281 16.4	257 21.3	+18 13.8	243 36.8	+15 01.8	231 37.8	+17 31.0	77 16.5	− 7 01.9	49 38.1	99	−23 49.4	70
7	296 18.9	272 24.9	13.3	258 37.5	02.4	246 39.8	31.1	92 19.1	01.8	64 07.0	98	23 56.4	69
8	311 21.4	287 28.4	12.9	273 38.2	03.0	261 41.7	31.2	107 21.8	01.8	78 35.8	98	24 03.3	68
9	326 23.8	302 32.0	•• 12.5	288 38.9	•• 03.6	276 43.6	•• 31.4	122 24.4	•• 01.7	93 04.6	96	•24 10.1	67
10	341 26.3	317 35.5	12.1	303 39.6	04.2	291 45.6	31.5	137 27.1	01.6	107 33.2	96	24 16.8	66
11	356 28.8	332 39.0	11.6	318 40.3	04.8	306 47.5	31.7	152 29.7	01.6	122 01.8	94	24 23.4	64
12	11 31.2	347 42.6	+18 11.2	333 41.0	+15 05.4	321 49.5	+17 31.8	167 32.3	− 7 01.5	136 30.2	94	−24 29.8	63
13	26 33.7	2 46.2	10.8	348 41.7	06.0	336 51.4	32.0	182 35.0	01.4	150 58.6	94	24 36.1	62
14	41 36.2	17 49.7	10.3	3 42.4	06.5	351 53.3	32.1	197 37.6	01.4	165 27.0	92	24 42.3	61
15	56 38.6	32 53.3	•• 09.9	18 43.1	•• 07.1	6 55.3	•• 32.2	212 40.2	•• 01.3	179 55.2	91	•24 48.4	59
16	71 41.1	47 56.8	09.4	33 43.8	07.7	21 57.2	32.4	227 42.9	01.2	194 23.3	91	24 54.3	59
17	86 43.6	63 00.4	09.0	48 44.5	08.3	36 59.1	32.5	242 45.5	01.1	208 51.4	90	25 00.1	57
18	101 46.0	78 04.0	+18 08.5	63 45.2	+15 08.9	52 01.1	+17 32.7	257 48.2	− 7 01.1	223 19.4	89	−25 05.8	56
19	116 48.5	93 07.5	08.1	78 45.9	09.5	67 03.0	32.8	272 50.8	01.0	237 47.3	89	25 11.4	54
20	131 50.9	108 11.1	07.6	93 46.6	10.1	82 04.9	32.9	287 53.4	00.9	252 15.2	87	25 16.8	53
21	146 53.4	123 14.7	•• 07.2	108 47.3	•• 10.7	97 06.9	•• 33.1	302 56.1	•• 00.9	266 42.9	87	•25 22.1	51
22	161 55.9	138 18.2	06.7	123 48.0	11.3	112 08.8	33.2	317 58.7	00.8	281 10.6	86	25 27.2	51
23	176 58.3	153 21.8	06.3	138 48.7	11.9	127 10.7	33.4	333 01.3	00.7	295 38.2	86	25 32.3	49
24	192 00.8	168 25.4	+18 05.8	153 49.5	+15 12.4	142 12.7	+17 33.5	348 04.0	− 7 00.7	310 05.8	85	−25 37.2	47
code	−	+ 35	− 4	+ 7	+ 6	+ 19	+ 2	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
1 0h	178 58.6	+ 4 20.5
1	193 58.8	21.5
2	208 59.0	22.4
3	223 59.2	23.4
4	238 59.3	24.4
5	253 59.5	25.3
6	268 59.7	+ 4 26.3
7	283 59.9	27.3
8	299 00.1	28.2
9	314 00.3	29.2
10	329 00.5	30.1
11	344 00.7	31.1
12	359 00.9	+ 4 32.1
13	14 01.0	33.0
14	29 01.2	34.0
15	44 01.4	35.0
16	59 01.6	35.9
17	74 01.8	36.9
18	89 02.0	+ 4 37.9
19	104 02.2	38.8
20	119 02.4	39.8
21	134 02.5	40.7
22	149 02.7	41.7
23	164 02.9	42.7
2 0	179 03.1	+ 4 43.6
1	194 03.3	44.6
2	209 03.5	45.6
3	224 03.7	46.5
4	239 03.9	47.5
5	254 04.0	48.4
6	269 04.2	+ 4 49.4
7	284 04.4	50.4
8	299 04.6	51.3
9	314 04.8	52.3
10	329 05.0	53.3
11	344 05.2	54.2
12	359 05.4	+ 4 55.2
13	14 05.5	56.1
14	29 05.7	57.1
15	44 05.9	58.1
16	59 06.1	4 59.0
17	74 06.3	5 00.0
18	89 06.5	+ 5 00.9
19	104 06.7	01.9
20	119 06.8	02.9
21	134 07.0	03.8
22	149 07.2	04.8
23	164 07.4	05.7
3 0	179 07.6	+ 5 06.7
1	194 07.8	07.7
2	209 08.0	08.6
3	224 08.1	09.6
4	239 08.3	10.5
5	254 08.5	11.5
6	269 08.7	+ 5 12.4
7	284 08.9	13.4
8	299 09.1	14.4
9	314 09.3	15.3
10	329 09.4	16.3
11	344 09.6	17.2
12	359 09.8	+ 5 18.2
13	14 10.0	19.2
14	29 10.2	20.1
15	44 10.4	21.1
16	59 10.6	22.0
17	74 10.7	23.0
18	89 10.9	+ 5 23.9
19	104 11.1	24.9
20	119 11.3	25.8
21	134 11.5	26.8
22	149 11.7	27.8
23	164 11.9	28.7
24	179 12.0	+ 5 29.7
code	—	+ 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.8	−40 29.5
5	Achernar	336 00.6	−57 28.4
30	Acrux	173 59.5	−62 50.6
19	Adhara	255 48.0	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.6	−47 11.2
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.9	+26 51.9
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.4	+ 8 44.4
2	Ankaa	354 00.5	−42 33.6
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 03.8	−68 56.6
22	Avior	234 36.5	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.3	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.6	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.5	−18 14.6
27	Dubhe	194 46.1	+62 00.2
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 07.0	+51 29.2
54	Enif	34 31.7	+ 9 39.4
56	Fomalhaut	16 14.0	−29 52.2
31	Gacrux	172 51.0	−56 51.3
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.7	−60 09.0
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.6	−34 24.6
40	Kochab	137 16.4	+74 20.5
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.2	−69 31.7
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.2	−26 21.5
52	Peacock	54 30.4	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.3	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.2	−60 38.8
44	Sabik	103 04.2	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.1	−37 04.3
18	Sirius	259 13.6	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.6	−43 14.8
49	Vega	81 09.5	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 1	2	3
h	m s	m s	m s
0	− 4 06.0	− 3 48.0	− 3 30.0
6	− 4 01.5	− 3 43.5	− 3 25.6
12	− 3 57.0	− 3 39.0	− 3 21.1
18	− 3 52.5	− 3 34.5	− 3 16.7
24	− 3 48.0	− 3 30.0	− 3 12.2

Lat.	Sunrise	Twlt. begins	Moonrise 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	4 52	////	■	■	■	■
70	5 00	////	25 09	1 09	■	■
68	5 06	////	23 48	■	■	■
66	5 11	1 19	23 10	25 38	1 38	■
64	5 16	2 00	22 44	24 38	0 38	■
62	5 20	2 27	22 24	24 04	0 04	1 47
60	5 23	2 46	22 08	23 39	25 10	1 10
58	5 26	3 02	21 54	23 20	24 44	0 44
56	5 29	3 14	21 42	23 04	24 23	0 23
54	5 31	3 26	21 32	22 50	24 06	0 06
52	5 33	3 35	21 23	22 38	23 52	24 58
50	5 35	3 43	21 14	22 28	23 39	24 44
45	5 39	3 59	20 57	22 06	23 13	24 16
40	5 43	4 12	20 43	21 48	22 52	23 54
35	5 46	4 21	20 31	21 33	22 35	23 36
30	5 49	4 29	20 21	21 20	22 21	23 20
20	5 53	4 40	20 03	20 59	21 56	22 53
10	5 57	4 47	19 48	20 40	21 34	22 31
0	6 00	4 52	19 34	20 22	21 14	22 09
10	6 04	4 54	19 20	20 05	20 54	21 48
20	6 07	4 54	19 05	19 46	20 33	21 25
30	6 11	4 51	18 48	19 25	20 09	20 59
35	6 13	4 48	18 38	19 13	19 54	20 43
40	6 16	4 45	18 27	18 59	19 38	20 25
45	6 18	4 39	18 14	18 42	19 18	20 04
50	6 22	4 32	17 58	18 21	18 53	19 36
52	6 23	4 29	17 50	18 12	18 42	19 23
54	6 25	4 25	17 42	18 01	18 28	19 08
56	6 27	4 21	17 33	17 48	18 13	18 50
58	6 29	4 14	17 22	17 34	17 54	18 28
60	6 31	4 08	17 10	17 17	17 31	17 59

Lat.	Sunset	Twlt. ends	Moonset 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	19 18	////	3 01	■	■	■
70	19 10	////	3 38	2 05	■	■
68	19 03	////	4 04	3 27	■	■
66	18 58	23 03	4 25	4 06	3 21	■
64	18 53	22 16	4 41	4 33	4 21	■
62	18 49	21 48	4 54	4 54	4 55	5 02
60	18 46	21 27	5 06	5 11	5 20	5 39
58	18 43	21 11	5 16	5 25	5 40	6 05
56	18 40	20 57	5 25	5 38	5 57	6 26
54	18 37	20 46	5 33	5 49	6 11	6 43
52	18 35	20 36	5 40	5 58	6 23	6 58
50	18 33	20 28	5 46	6 07	6 34	7 11
45	18 29	20 11	6 00	6 25	6 57	7 38
40	18 25	19 58	6 12	6 41	7 16	7 59
35	18 22	19 48	6 21	6 53	7 31	8 16
30	18 19	19 40	6 30	7 05	7 45	8 32
20	18 15	19 29	6 45	7 24	8 08	8 57
10	18 11	19 21	6 58	7 41	8 28	9 20
0	18 07	19 16	7 10	7 57	8 47	9 40
10	18 03	19 13	7 23	8 13	9 06	10 01
20	18 00	19 13	7 36	8 30	9 26	10 23
30	17 56	19 15	7 51	8 49	9 49	10 49
35	17 54	19 18	8 00	9 01	10 03	11 04
40	17 51	19 21	8 10	9 14	10 19	11 22
45	17 48	19 25	8 22	9 30	10 38	11 44
50	17 45	19 32	8 37	9 49	11 02	12 11
52	17 43	19 35	8 43	9 59	11 13	12 24
54	17 41	19 39	8 51	10 09	11 27	12 39
56	17 40	19 44	9 00	10 21	11 42	12 57
58	17 38	19 49	9 09	10 34	12 00	13 19
60	17 35	19 55	9 20	10 51	12 22	13 47

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
1	1 00	13 00	13 47	14 39	1 00
2	1 45	12 55	13 46	14 36	0 56
3	2 34	12 49	13 45	14 32	0 52
4	3 27	12 43	13 44	14 29	0 48

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.5	0.1
30	0.3	0.4	0.1
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	1	2	3
°	′	′	′
0	13.0	13.5	14.2
4	13.0	13.5	14.2
8	13.0	13.5	14.2
12	13.1	13.6	14.2
16	13.1	13.6	14.2
20	13.2	13.6	14.2
24	13.2	13.7	14.3
28	13.3	13.7	14.3
32	13.3	13.8	14.3
36	13.4	13.9	14.4
40	13.5	13.9	14.4
44	13.6	14.0	14.5
48	13.7	14.1	14.5
52	13.8	14.2	14.6
56	13.9	14.3	14.7
60	14.1	14.4	14.7
64	14.2	14.5	14.8
68	14.3	14.6	14.9
72	14.5	14.7	14.9
76	14.6	14.8	15.0
80	14.7	14.9	15.1
84	14.9	15.0	15.2
88	15.0	15.1	15.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	1	2	3
°	′	′	′
0	17.0	16.7	16.4
4	17.0	16.7	16.3
8	17.0	16.7	16.3
12	16.9	16.7	16.3
16	16.9	16.6	16.3
20	16.9	16.6	16.3
24	16.8	16.6	16.2
28	16.7	16.5	16.2
32	16.7	16.4	16.2
36	16.6	16.4	16.1
40	16.5	16.3	16.1
44	16.4	16.2	16.0
48	16.3	16.1	16.0
52	16.2	16.1	15.9
56	16.1	16.0	15.8
60	15.9	15.9	15.8
64	15.8	15.8	15.7
68	15.7	15.7	15.6
72	15.6	15.6	15.6
76	15.4	15.4	15.5
80	15.3	15.3	15.4
84	15.1	15.2	15.3
88	15.0	15.1	15.3
90			

Subtract from table, back cover

918768°—52——5

GMT	♈ GHA	VENUS −3.6 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
4 0	192 00.8	168 25.4	+18 05.8	153 49.5	+15 12.4	142 12.7	+17 33.5	348 04.0	− 7 00.7	310 05.8	85	−25 37.2	− 47
1	207 03.3	183 29.0	05.3	168 50.2	13.0	157 14.6	33.6	3 06.6	00.6	324 33.3	83	25 41.9	− 47
2	222 05.7	198 32.6	04.9	183 50.9	13.6	172 16.5	33.8	18 09.3	00.5	339 00.6	84	25 46.6	− 44
3	237 08.2	213 36.2	•• 04.4	198 51.6	•• 14.2	187 18.5	•• 33.9	33 11.9	•• 00.4	353 28.0	82	•25 51.0	− 44
4	252 10.7	228 39.8	03.9	213 52.3	14.8	202 20.4	34.1	48 14.5	00.4	7 55.2	82	25 55.4	− 42
5	267 13.1	243 43.4	03.4	228 53.0	15.4	217 22.3	34.2	63 17.2	00.3	22 22.4	81	25 59.6	− 41
6	282 15.6	258 47.0	+18 03.0	243 53.7	+15 16.0	232 24.3	+17 34.4	78 19.8	− 7 00.2	36 49.5	81	−26 03.7	− 39
7	297 18.1	273 50.6	02.5	258 54.4	16.6	247 26.2	34.5	93 22.5	00.2	51 16.6	79	26 07.6	− 38
8	312 20.5	288 54.2	02.0	273 55.1	17.1	262 28.1	34.6	108 25.1	00.1	65 43.5	80	26 11.4	− 36
9	327 23.0	303 57.8	•• 01.5	288 55.8	•• 17.7	277 30.1	•• 34.8	123 27.7	• 7 00.0	80 10.5	78	•26 15.0	− 35
10	342 25.4	319 01.4	01.0	303 56.5	18.3	292 32.0	34.9	138 30.4	6 59.9	94 37.3	78	26 18.5	− 34
11	357 27.9	334 05.0	00.5	318 57.2	18.9	307 33.9	35.1	153 33.0	59.9	109 04.1	77	26 21.9	− 32
12	12 30.4	349 08.6	+18 00.0	333 57.9	+15 19.5	322 35.9	+17 35.2	168 35.6	− 6 59.8	123 30.8	77	−26 25.1	− 30
13	27 32.8	4 12.2	17 59.5	348 58.6	20.1	337 37.8	35.3	183 38.3	59.7	137 57.5	76	26 28.1	− 30
14	42 35.3	19 15.8	59.0	3 59.3	20.7	352 39.7	35.5	198 40.9	59.7	152 24.1	75	26 31.1	− 27
15	57 37.8	34 19.5	•• 58.5	19 00.0	•• 21.2	7 41.7	•• 35.6	213 43.6	•• 59.6	166 50.6	75	•26 33.8	− 27
16	72 40.2	49 23.1	58.0	34 00.7	21.8	22 43.6	35.8	228 46.2	59.5	181 17.1	75	26 36.5	− 24
17	87 42.7	64 26.7	57.5	49 01.4	22.4	37 45.5	35.9	243 48.8	59.5	195 43.6	73	26 38.9	− 24
18	102 45.2	79 30.3	+17 57.0	64 02.1	+15 23.0	52 47.5	+17 36.0	258 51.5	− 6 59.4	210 09.9	74	−26 41.3	− 21
19	117 47.6	94 34.0	56.5	79 02.8	23.6	67 49.4	36.2	273 54.1	59.3	224 36.3	72	26 43.4	− 20
20	132 50.1	109 37.6	56.0	94 03.5	24.2	82 51.3	36.3	288 56.8	59.2	239 02.5	73	26 45.4	− 19
21	147 52.6	124 41.2	•• 55.5	109 04.2	•• 24.7	97 53.3	•• 36.5	303 59.4	•• 59.2	253 28.8	71	•26 47.3	− 17
22	162 55.0	139 44.9	54.9	124 04.9	25.3	112 55.2	36.6	319 02.0	59.1	267 54.9	71	26 49.0	− 16
23	177 57.5	154 48.5	54.4	139 05.6	25.9	127 57.1	36.8	334 04.7	59.0	282 21.0	71	26 50.6	− 14
5 0	192 59.9	169 52.2	+17 53.9	154 06.3	+15 26.5	142 59.0	+17 36.9	349 07.3	− 6 59.0	296 47.1	71	−26 52.0	− 13
1	208 02.4	184 55.8	53.4	169 07.0	27.1	158 01.0	37.0	4 10.0	58.9	311 13.2	69	26 53.3	− 11
2	223 04.9	199 59.5	52.8	184 07.7	27.7	173 02.9	37.2	19 12.6	58.8	325 39.1	70	26 54.4	− 9
3	238 07.3	215 03.1	•• 52.3	199 08.4	•• 28.2	188 04.8	•• 37.3	34 15.2	•• 58.7	340 05.1	69	•26 55.3	− 8
4	253 09.8	230 06.8	51.8	214 09.1	28.8	203 06.8	37.5	49 17.9	58.7	354 31.0	69	26 56.1	− 6
5	268 12.3	245 10.4	51.2	229 09.8	29.4	218 08.7	37.6	64 20.5	58.6	8 56.9	68	26 56.7	− 5
6	283 14.7	260 14.1	+17 50.7	244 10.5	+15 30.0	233 10.6	+17 37.7	79 23.2	− 6 58.5	23 22.7	68	−26 57.2	− 3
7	298 17.2	275 17.7	50.1	259 11.2	30.6	248 12.6	37.9	94 25.8	58.5	37 48.5	67	26 57.5	− 2
8	313 19.7	290 21.4	49.6	274 11.9	31.1	263 14.5	38.0	109 28.4	58.4	52 14.2	67	26 57.7	0
9	328 22.1	305 25.1	•• 49.1	289 12.6	•• 31.7	278 16.4	•• 38.2	124 31.1	•• 58.3	66 39.9	67	•26 57.7	+ 2
10	343 24.6	320 28.7	48.5	304 13.3	32.3	293 18.3	38.3	139 33.7	58.3	81 05.6	67	26 57.5	+ 3
11	358 27.1	335 32.4	48.0	319 14.0	32.9	308 20.3	38.4	154 36.4	58.2	95 31.3	66	26 57.2	+ 5
12	13 29.5	350 36.1	+17 47.4	334 14.7	+15 33.5	323 22.2	+17 38.6	169 39.0	− 6 58.1	109 56.9	66	−26 56.7	+ 6
13	28 32.0	5 39.7	46.8	349 15.4	34.0	338 24.1	38.7	184 41.6	58.0	124 22.5	66	26 56.1	+ 8
14	43 34.4	20 43.4	46.3	4 16.1	34.6	353 26.1	38.9	199 44.3	58.0	138 48.1	66	26 55.3	+ 10
15	58 36.9	35 47.1	•• 45.7	19 16.8	•• 35.2	8 28.0	•• 39.0	214 46.9	•• 57.9	153 13.7	65	•26 54.3	+ 11
16	73 39.4	50 50.8	45.2	34 17.5	35.8	23 29.9	39.2	229 49.6	57.8	167 39.2	65	26 53.2	+ 13
17	88 41.8	65 54.4	44.6	49 18.2	36.4	38 31.9	39.3	244 52.2	57.8	182 04.7	65	26 51.9	+ 15
18	103 44.3	80 58.1	+17 44.0	64 18.9	+15 36.9	53 33.8	+17 39.4	259 54.8	− 6 57.7	196 30.2	65	−26 50.4	+ 16
19	118 46.8	96 01.8	43.4	79 19.6	37.5	68 35.7	39.6	274 57.5	57.6	210 55.7	64	26 48.8	+ 17
20	133 49.2	111 05.5	42.9	94 20.3	38.1	83 37.6	39.7	290 00.1	57.5	225 21.1	65	26 47.1	+ 20
21	148 51.7	126 09.2	•• 42.3	109 21.0	•• 38.7	98 39.6	•• 39.9	305 02.8	•• 57.5	239 46.6	64	•26 45.1	+ 21
22	163 54.2	141 12.9	41.7	124 21.7	39.2	113 41.5	40.0	320 05.4	57.4	254 12.0	64	26 43.0	+ 22
23	178 56.6	156 16.6	41.1	139 22.4	39.8	128 43.4	40.1	335 08.0	57.3	268 37.4	64	26 40.8	+ 24
6 0	193 59.1	171 20.3	+17 40.5	154 23.1	+15 40.4	143 45.4	+17 40.3	350 10.7	− 6 57.3	283 02.8	64	−26 38.4	+ 26
1	209 01.5	186 24.0	40.0	169 23.8	41.0	158 47.3	40.4	5 13.3	57.2	297 28.2	64	26 35.8	+ 28
2	224 04.0	201 27.7	39.4	184 24.5	41.5	173 49.2	40.6	20 16.0	57.1	311 53.6	64	26 33.0	+ 29
3	239 06.5	216 31.4	•• 38.8	199 25.2	•• 42.1	188 51.1	•• 40.7	35 18.6	•• 57.0	326 19.0	64	•26 30.1	+ 30
4	254 08.9	231 35.1	38.2	214 25.9	42.7	203 53.1	40.8	50 21.2	57.0	340 44.4	64	26 27.1	+ 33
5	269 11.4	246 38.8	37.6	229 26.6	43.3	218 55.0	41.0	65 23.9	56.9	355 09.8	64	26 23.8	+ 34
6	284 13.9	261 42.5	+17 37.0	244 27.3	+15 43.8	233 56.9	+17 41.1	80 26.5	− 6 56.8	9 35.2	63	−26 20.4	+ 35
7	299 16.3	276 46.2	36.4	259 27.9	44.4	248 58.8	41.3	95 29.2	56.8	24 00.5	64	26 16.9	+ 37
8	314 18.8	291 49.9	35.8	274 28.6	45.0	264 00.8	41.4	110 31.8	56.7	38 25.9	64	26 13.2	+ 39
9	329 21.3	306 53.6	•• 35.2	289 29.3	•• 45.6	279 02.7	•• 41.5	125 34.4	•• 56.6	52 51.3	64	•26 09.3	+ 41
10	344 23.7	321 57.3	34.6	304 30.0	46.1	294 04.6	41.7	140 37.1	56.6	67 16.7	64	26 05.2	+ 42
11	359 26.2	337 01.1	34.0	319 30.7	46.7	309 06.5	41.8	155 39.7	56.5	81 42.1	64	26 01.0	+ 43
12	14 28.7	352 04.8	+17 33.3	334 31.4	+15 47.3	324 08.5	+17 42.0	170 42.4	− 6 56.4	96 07.5	65	−25 56.7	+ 46
13	29 31.1	7 08.5	32.7	349 32.1	47.9	339 10.4	42.1	185 45.0	56.3	110 33.0	64	25 52.1	+ 47
14	44 33.6	22 12.2	32.1	4 32.8	48.4	354 12.3	42.3	200 47.6	56.3	124 58.4	64	25 47.4	+ 48
15	59 36.0	37 16.0	•• 31.5	19 33.5	•• 49.0	9 14.3	•• 42.4	215 50.3	•• 56.2	139 23.8	65	•25 42.6	+ 50
16	74 38.5	52 19.7	30.9	34 34.2	49.6	24 16.2	42.5	230 52.9	56.1	153 49.3	65	25 37.6	+ 52
17	89 41.0	67 23.4	30.2	49 34.9	50.1	39 18.1	42.7	245 55.6	56.1	168 14.8	65	25 32.4	+ 53
18	104 43.4	82 27.1	+17 29.6	64 35.6	+15 50.7	54 20.0	+17 42.8	260 58.2	− 6 56.0	182 40.3	65	−25 27.1	+ 55
19	119 45.9	97 30.9	29.0	79 36.3	51.3	69 22.0	43.0	276 00.8	55.9	197 05.8	65	25 21.6	+ 57
20	134 48.4	112 34.6	28.3	94 37.0	51.9	84 23.9	43.1	291 03.5	55.8	211 31.3	65	25 15.9	+ 58
21	149 50.8	127 38.4	•• 27.7	109 37.7	•• 52.4	99 25.8	•• 43.2	306 06.1	•• 55.8	225 56.8	66	•25 10.1	+ 60
22	164 53.3	142 42.1	27.1	124 38.4	53.0	114 27.7	43.4	321 08.8	55.7	240 22.4	66	25 04.1	+ 61
23	179 55.8	157 45.8	26.4	139 39.1	53.6	129 29.7	43.5	336 11.4	55.6	254 48.0	66	24 58.0	+ 63
24	194 58.2	172 49.6	+17 25.8	154 39.8	+15 54.1	144 31.6	+17 43.7	351 14.1	− 6 55.6	269 13.6	67	−24 51.7	+ 64
code	−	+ 36	− 6	+ 7	+ 5	+ 19	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
4 0	179 12.0	+ 5 29.7
1	194 12.2	30.6
2	209 12.4	31.6
3	224 12.6	32.5
4	239 12.8	33.5
5	254 13.0	34.4
6	269 13.1	+ 5 35.4
7	284 13.3	36.4
8	299 13.5	37.3
9	314 13.7	38.3
10	329 13.9	39.2
11	344 14.1	40.2
12	359 14.2	+ 5 41.1
13	14 14.4	42.1
14	29 14.6	43.0
15	44 14.8	44.0
16	59 15.0	44.9
17	74 15.2	45.9
18	89 15.3	+ 5 46.8
19	104 15.5	47.8
20	119 15.7	48.7
21	134 15.9	49.7
22	149 16.1	50.6
23	164 16.3	51.6
5 0	179 16.4	+ 5 52.5
1	194 16.6	53.5
2	209 16.8	54.4
3	224 17.0	55.4
4	239 17.2	56.3
5	254 17.4	57.3
6	269 17.5	+ 5 58.3
7	284 17.7	5 59.2
8	299 17.9	6 00.2
9	314 18.1	01.1
10	329 18.3	02.0
11	344 18.4	03.0
12	359 18.6	+ 6 03.9
13	14 18.8	04.9
14	29 19.0	05.8
15	44 19.2	06.8
16	59 19.4	07.7
17	74 19.5	08.7
18	89 19.7	+ 6 09.6
19	104 19.9	10.6
20	119 20.1	11.5
21	134 20.3	12.5
22	149 20.4	13.4
23	164 20.6	14.4
6 0	179 20.8	+ 6 15.3
1	194 21.0	16.3
2	209 21.2	17.2
3	224 21.3	18.2
4	239 21.5	19.1
5	254 21.7	20.1
6	269 21.9	+ 6 21.0
7	284 22.1	21.9
8	299 22.2	22.9
9	314 22.4	23.8
10	329 22.6	24.8
11	344 22.8	25.7
12	359 23.0	+ 6 26.7
13	14 23.1	27.6
14	29 23.3	28.6
15	44 23.5	29.5
16	59 23.7	30.5
17	74 23.9	31.4
18	89 24.0	+ 6 32.3
19	104 24.2	33.3
20	119 24.4	34.2
21	134 24.6	35.2
22	149 24.8	36.1
23	164 24.9	37.1
24	179 25.1	+ 6 38.0
code	—	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.5
5	Achernar	336 00.6	−57 28.4
30	Acrux	173 59.5	−62 50.6
19	Adhara	255 48.1	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.6
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.5	−47 11.2
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.9	+26 51.9
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.3	+ 8 44.4
2	Ankaa	354 00.5	−42 33.5
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.6	+19 25.2
43	Atria	109 03.7	−68 56.6
22	Avior	234 36.5	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.3	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.6	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.4	−18 14.6
27	Dubhe	194 46.1	+62 00.3
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 07.0	+51 29.2
54	Enif	34 31.7	+ 9 39.4
56	Fomalhaut	16 13.9	−29 52.2
31	Gacrux	172 51.0	−56 51.3
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.7	−60 09.0
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.6	−34 24.6
40	Kochab	137 16.4	+74 20.5
57	Markab	14 23.7	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.2	−69 31.8
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.2	−26 21.5
52	Peacock	54 30.4	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.7
46	R'alhague	96 48.2	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.2	−60 38.8
44	Sabik	103 04.2	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.1	−37 04.3
18	Sirius	259 13.6	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.6	−43 14.8
49	Vega	81 09.5	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 4	5	6
h	m s	m s	m s
0	− 3 12.2	− 2 54.6	− 2 37.2
6	− 3 07.8	− 2 50.2	− 2 32.8
12	− 3 03.4	− 2 45.9	− 2 28.5
18	− 2 59.0	− 2 41.5	− 2 24.2
24	− 2 54.6	− 2 37.2	− 2 19.9

Lat.	Sunrise	Twlt. begins	Moonrise 4	5	6	7
N °	h m	h m	h m	h m	h m	h m
72	4 36	////	▬	▬	▬	▬
70	4 46	////	▬	▬	▬	▬
68	4 53	////	▬	▬	▬	▬
66	5 00	0 22	▬	▬	▬	▬
64	5 05	1 37	▬	▬	▬	4 49
62	5 10	2 09	1 47	3 15	3 58	4 09
60	5 14	2 32	1 10	2 27	3 16	3 41
58	5 18	2 50	0 44	1 56	2 48	3 20
56	5 21	3 05	0 23	1 33	2 26	3 02
54	5 24	3 16	0 06	1 14	2 08	2 47
52	5 26	3 27	24 58	0 58	1 53	2 34
50	5 29	3 35	24 44	0 44	1 39	2 22
45	5 34	3 53	24 16	0 16	1 12	1 58
40	5 38	4 06	23 54	24 50	0 50	1 38
35	5 42	4 16	23 36	24 32	0 32	1 22
30	5 45	4 25	23 20	24 17	0 17	1 08
20	5 50	4 37	22 53	23 50	24 44	0 44
10	5 55	4 46	22 31	23 28	24 23	0 23
0	5 59	4 51	22 09	23 06	24 04	0 04
10	6 04	4 54	21 48	22 45	23 44	24 44
20	6 08	4 55	21 25	22 23	23 23	24 26
30	6 13	4 53	20 59	21 56	22 59	24 06
35	6 16	4 51	20 43	21 41	22 45	23 54
40	6 19	4 48	20 25	21 23	22 28	23 40
45	6 22	4 44	20 04	21 01	22 08	23 23
50	6 27	4 38	19 36	20 33	21 43	23 03
52	6 28	4 35	19 23	20 20	21 31	22 53
54	6 31	4 31	19 08	20 04	21 17	22 42
56	6 33	4 27	18 50	19 46	21 01	22 30
58	6 35	4 22	18 28	19 23	20 42	22 15
60	6 38	4 17	17 59	18 54	20 18	21 58
S						

Lat.	Sunset	Twlt. ends	Moonset 4	5	6	7
N °	h m	h m	h m	h m	h m	h m
72	19 33	////	▬	▬	▬	▬
70	19 23	////	▬	▬	▬	▬
68	19 15	////	▬	▬	▬	▬
66	19 08	////	▬	▬	▬	▬
64	19 02	22 39	▬	▬	▬	7 56
62	18 57	22 04	5 02	5 30	6 47	8 35
60	18 53	21 40	5 39	6 18	7 28	9 03
58	18 49	21 21	6 05	6 49	7 56	9 24
56	18 46	21 07	6 26	7 12	8 18	9 41
54	18 43	20 54	6 43	7 31	8 36	9 56
52	18 40	20 43	6 58	7 47	8 51	10 09
50	18 38	20 34	7 11	8 01	9 04	10 20
45	18 33	20 16	7 38	8 29	9 31	10 43
40	18 28	20 02	7 59	8 51	9 53	11 02
35	18 24	19 51	8 16	9 10	10 10	11 17
30	18 21	19 43	8 32	9 25	10 26	11 31
20	18 15	19 29	8 57	9 52	10 51	11 53
10	18 11	19 22	9 20	10 15	11 13	12 13
0	18 06	19 15	9 40	10 36	11 34	12 31
10	18 02	19 12	10 01	10 58	11 54	12 49
20	17 57	19 10	10 23	11 21	12 16	13 08
30	17 52	19 11	10 49	11 47	12 42	13 30
35	17 49	19 13	11 04	12 03	12 56	13 43
40	17 46	19 16	11 22	12 21	13 13	13 58
45	17 43	19 20	11 44	12 43	13 34	14 16
50	17 38	19 25	12 11	13 11	14 00	14 37
52	17 36	19 28	12 24	13 24	14 12	14 47
54	17 34	19 32	12 39	13 40	14 26	14 59
56	17 32	19 36	12 57	13 59	14 43	15 12
58	17 29	19 40	13 19	14 21	15 02	15 27
60	17 26	19 45	13 47	14 51	15 27	15 45
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
4	3 27	12 43	13 44	14 29	0 48
5	4 23	12 38	13 43	14 26	0 43
6	5 20	12 32	13 42	14 23	0 39
7	6 18	12 26	13 41	14 20	0 35

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.5	0.1
30	0.3	0.4	0.1
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	4	5	6
°	′	′	′
0	14.9	15.7	16.6
4	14.9	15.7	16.6
8	14.9	15.7	16.6
12	14.9	15.7	16.5
16	14.9	15.7	16.5
20	15.0	15.7	16.5
24	15.0	15.7	16.5
28	15.0	15.7	16.5
32	15.0	15.7	16.4
36	15.0	15.7	16.4
40	15.0	15.7	16.4
44	15.1	15.6	16.3
48	15.1	15.6	16.3
52	15.1	15.6	16.2
56	15.1	15.6	16.2
60	15.2	15.6	16.1
64	15.2	15.6	16.1
68	15.2	15.6	16.0
72	15.3	15.6	16.0
76	15.3	15.6	15.9
80	15.3	15.6	15.9
84	15.4	15.6	15.8
88	15.4	15.6	15.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	4	5	6
°	′	′	′
0	15.9	15.5	15.0
4	15.9	15.5	15.0
8	15.9	15.5	15.0
12	15.9	15.5	15.0
16	15.9	15.5	15.0
20	15.9	15.5	15.0
24	15.9	15.5	15.0
28	15.8	15.5	15.1
32	15.8	15.5	15.1
36	15.8	15.5	15.1
40	15.8	15.5	15.2
44	15.8	15.5	15.2
48	15.7	15.5	15.3
52	15.7	15.5	15.3
56	15.7	15.5	15.3
60	15.6	15.5	15.4
64	15.6	15.5	15.4
68	15.6	15.5	15.5
72	15.6	15.6	15.5
76	15.5	15.6	15.6
80	15.5	15.6	15.7
84	15.4	15.6	15.7
88	15.4	15.6	15.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.4 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
7 0	194 58.2	172 49.6	+17 25.8	154 39.8	+15 54.1	144 31.6	+17 43.7	351 14.1	− 6 55.6	269 13.6	67	−24 51.7	+ 64
1	210 00.7	187 53.3	25.1	169 40.5	54.7	159 33.5	43.8	6 16.7	55.5	283 39.3	67	24 45.3	+ 66
2	225 03.2	202 57.1	24.5	184 41.2	55.3	174 35.4	43.9	21 19.3	55.4	298 05.0	67	24 38.7	+ 68
3	240 05.6	218 00.8	·· 23.8	199 41.9	·· 55.9	189 37.4	·· 44.1	36 22.0	·· 55.3	312 30.7	67	·24 31.9	+ 69
4	255 08.1	233 04.6	23.2	214 42.6	56.4	204 39.3	44.2	51 24.6	55.3	326 56.4	67	24 25.0	+ 70
5	270 10.5	248 08.3	22.5	229 43.3	57.0	219 41.2	44.4	66 27.3	55.2	341 22.1	68	24 18.0	+ 73
6	285 13.0	263 12.1	+17 21.9	244 44.0	+15 57.6	234 43.1	+17 44.5	81 29.9	− 6 55.1	355 47.9	69	−24 10.7	+ 73
7	300 15.5	278 15.8	21.2	259 44.7	58.1	249 45.1	44.7	96 32.5	55.1	10 13.8	68	24 03.4	+ 75
8	315 17.9	293 19.6	20.6	274 45.4	58.7	264 47.0	44.8	111 35.2	55.0	24 39.6	69	23 55.9	+ 77
9	330 20.4	308 23.3	·· 19.9	289 46.1	·· 59.3	279 48.9	·· 44.9	126 37.8	·· 54.9	39 05.5	69	·23 48.2	+ 79
10	345 22.9	323 27.1	19.2	304 46.7	15 59.8	294 50.8	45.1	141 40.5	54.9	53 31.4	70	23 40.3	+ 79
11	0 25.3	338 30.8	18.6	319 47.4	16 00.4	309 52.7	45.2	156 43.1	54.8	67 57.4	70	23 32.4	+ 82
12	15 27.8	353 34.6	+17 17.9	334 48.1	+16 01.0	324 54.7	+17 45.4	171 45.8	− 6 54.7	82 23.4	70	−23 24.2	+ 82
13	30 30.3	8 38.4	17.2	349 48.8	01.5	339 56.6	45.5	186 48.4	54.6	96 49.4	71	23 16.0	+ 85
14	45 32.7	23 42.1	16.5	4 49.5	02.1	354 58.5	45.6	201 51.0	54.6	111 15.5	71	23 07.5	+ 85
15	60 35.2	38 45.9	·· 15.9	19 50.2	·· 02.7	10 00.4	·· 45.8	216 53.7	·· 54.5	125 41.6	72	·22 59.0	+ 88
16	75 37.7	53 49.7	15.2	34 50.9	03.2	25 02.4	45.9	231 56.3	54.4	140 07.8	71	22 50.2	+ 88
17	90 40.1	68 53.4	14.5	49 51.6	03.8	40 04.3	46.1	246 59.0	54.4	154 33.9	73	22 41.4	+ 91
18	105 42.6	83 57.2	+17 13.8	64 52.3	+16 04.4	55 06.2	+17 46.2	262 01.6	− 6 54.3	169 00.2	73	−22 32.3	+ 91
19	120 45.0	99 01.0	13.1	79 53.0	04.9	70 08.1	46.3	277 04.2	54.2	183 26.5	73	22 23.2	+ 93
20	135 47.5	114 04.7	12.5	94 53.7	05.5	85 10.1	46.5	292 06.9	54.1	197 52.8	73	22 13.9	+ 95
21	150 50.0	129 08.5	·· 11.8	109 54.4	·· 06.0	100 12.0	·· 46.6	307 09.5	·· 54.1	212 19.1	74	·22 04.4	+ 95
22	165 52.4	144 12.3	11.1	124 55.1	06.6	115 13.9	46.8	322 12.2	54.0	226 45.5	75	21 54.9	+ 98
23	180 54.9	159 16.1	10.4	139 55.8	07.2	130 15.8	46.9	337 14.8	53.9	241 12.0	75	21 45.1	+ 98
8 0	195 57.4	174 19.9	+17 09.7	154 56.5	+16 07.7	145 17.7	+17 47.1	352 17.5	− 6 53.9	255 38.5	75	−21 35.3	+100
1	210 59.8	189 23.6	09.0	169 57.2	08.3	160 19.7	47.2	7 20.1	53.8	270 05.0	76	21 25.3	+102
2	226 02.3	204 27.4	08.3	184 57.9	08.9	175 21.6	47.3	22 22.7	53.7	284 31.6	76	21 15.1	+103
3	241 04.8	219 31.2	·· 07.6	199 58.6	·· 09.4	190 23.5	·· 47.5	37 25.4	·· 53.6	298 58.2	77	·21 04.8	+104
4	256 07.2	234 35.0	06.9	214 59.2	10.0	205 25.4	47.6	52 28.0	53.6	313 24.9	77	20 54.4	+105
5	271 09.7	249 38.8	06.2	229 59.9	10.6	220 27.4	47.8	67 30.7	53.5	327 51.6	78	20 43.9	+107
6	286 12.1	264 42.6	+17 05.4	245 00.6	+16 11.1	235 29.3	+17 47.9	82 33.3	− 6 53.4	342 18.4	78	−20 33.2	+108
7	301 14.6	279 46.3	04.7	260 01.3	11.7	250 31.2	48.0	97 35.9	53.4	356 45.2	79	20 22.4	+110
8	316 17.1	294 50.1	04.0	275 02.0	12.2	265 33.1	48.2	112 38.6	53.3	11 12.1	79	20 11.4	+111
9	331 19.5	309 53.9	·· 03.3	290 02.7	·· 12.8	280 35.0	·· 48.3	127 41.2	·· 53.2	25 39.0	79	·20 00.3	+112
10	346 22.0	324 57.7	02.6	305 03.4	13.4	295 37.0	48.5	142 43.9	53.2	40 05.9	80	19 49.1	+113
11	1 24.5	340 01.5	01.9	320 04.1	13.9	310 38.9	48.6	157 46.5	53.1	54 32.9	81	19 37.8	+115
12	16 26.9	355 05.3	+17 01.1	335 04.8	+16 14.5	325 40.8	+17 48.7	172 49.2	− 6 53.0	69 00.0	81	−19 26.3	+116
13	31 29.4	10 09.1	17 00.4	350 05.5	15.0	340 42.7	48.9	187 51.8	52.9	83 27.1	81	19 14.7	+117
14	46 31.9	25 12.9	16 59.7	5 06.2	15.6	355 44.6	49.0	202 54.4	52.9	97 54.2	82	19 03.0	+118
15	61 34.3	40 16.7	·· 58.9	20 06.9	·· 16.2	10 46.6	·· 49.2	217 57.1	·· 52.8	112 21.4	83	·18 51.2	+120
16	76 36.8	55 20.5	58.2	35 07.6	16.7	25 48.5	49.3	232 59.7	52.7	126 48.7	83	18 39.2	+121
17	91 39.3	70 24.3	57.5	50 08.3	17.3	40 50.4	49.4	248 02.4	52.7	141 16.0	83	18 27.1	+122
18	106 41.7	85 28.1	+16 56.7	65 08.9	+16 17.8	55 52.3	+17 49.6	263 05.0	− 6 52.6	155 43.3	84	−18 14.9	+123
19	121 44.2	100 31.9	56.0	80 09.6	18.4	70 54.2	49.7	278 07.7	52.5	170 10.7	84	18 02.6	+124
20	136 46.6	115 35.7	55.3	95 10.3	19.0	85 56.2	49.9	293 10.3	52.4	184 38.1	85	17 50.2	+126
21	151 49.1	130 39.5	·· 54.5	110 11.0	·· 19.5	100 58.1	·· 50.0	308 12.9	·· 52.4	199 05.6	85	·17 37.6	+126
22	166 51.6	145 43.3	53.8	125 11.7	20.1	116 00.0	50.2	323 15.6	52.3	213 33.1	86	17 25.0	+128
23	181 54.0	160 47.1	53.0	140 12.4	20.6	131 01.9	50.3	338 18.2	52.2	228 00.7	86	17 12.2	+129
9 0	196 56.5	175 50.9	+16 52.3	155 13.1	+16 21.2	146 03.8	+17 50.4	353 20.9	− 6 52.2	242 28.3	87	−16 59.3	+130
1	211 59.0	190 54.7	51.5	170 13.8	21.7	161 05.8	50.6	8 23.5	52.1	256 56.0	87	16 46.3	+131
2	227 01.4	205 58.5	50.8	185 14.5	22.3	176 07.7	50.7	23 26.1	52.0	271 23.7	88	16 33.2	+133
3	242 03.9	221 02.3	·· 50.0	200 15.2	·· 22.9	191 09.6	·· 50.9	38 28.8	·· 51.9	285 51.5	88	·16 19.9	+133
4	257 06.4	236 06.1	49.3	215 15.9	23.4	206 11.5	51.0	53 31.4	51.9	300 19.3	88	16 06.6	+134
5	272 08.8	251 10.0	48.5	230 16.6	24.0	221 13.4	51.1	68 34.1	51.8	314 47.1	89	15 53.2	+136
6	287 11.3	266 13.8	+16 47.7	245 17.2	+16 24.5	236 15.4	+17 51.3	83 36.7	− 6 51.7	329 15.0	89	−15 39.6	+136
7	302 13.8	281 17.6	47.0	260 17.9	25.1	251 17.3	51.4	98 39.4	51.7	343 42.9	90	15 26.0	+138
8	317 16.2	296 21.4	46.2	275 18.6	25.6	266 19.2	51.6	113 42.0	51.6	358 10.9	91	15 12.2	+138
9	332 18.7	311 25.2	·· 45.4	290 19.3	·· 26.2	281 21.1	·· 51.7	128 44.6	·· 51.5	12 39.0	90	·14 58.4	+140
10	347 21.1	326 29.0	44.7	305 20.0	26.7	296 23.0	51.8	143 47.3	51.4	27 07.0	91	14 44.4	+140
11	2 23.6	341 32.8	43.9	320 20.7	27.3	311 24.9	52.0	158 49.9	51.4	41 35.1	92	14 30.4	+141
12	17 26.1	356 36.6	+16 43.1	335 21.4	+16 27.8	326 26.9	+17 52.1	173 52.6	− 6 51.3	56 03.3	92	−14 16.3	+143
13	32 28.5	11 40.5	42.3	350 22.1	28.4	341 28.8	52.3	188 55.2	51.2	70 31.5	92	14 02.0	+143
14	47 31.0	26 44.3	41.6	5 22.8	29.0	356 30.7	52.4	203 57.9	51.2	84 59.7	93	13 47.7	+144
15	62 33.5	41 48.1	·· 40.8	20 23.5	·· 29.5	11 32.6	·· 52.5	219 00.5	·· 51.1	99 28.0	93	·13 33.3	+145
16	77 35.9	56 51.9	40.0	35 24.1	30.1	26 34.5	52.7	234 03.1	51.0	113 56.3	93	13 18.8	+146
17	92 38.4	71 55.7	39.2	50 24.8	30.6	41 36.5	52.8	249 05.8	50.9	128 24.6	94	13 04.2	+147
18	107 40.9	86 59.6	+16 38.4	65 25.5	+16 31.2	56 38.4	+17 53.0	264 08.4	− 6 50.9	142 53.0	95	−12 49.5	+147
19	122 43.3	102 03.4	37.6	80 26.2	31.7	71 40.3	53.1	279 11.1	50.8	157 21.5	94	12 34.8	+149
20	137 45.8	117 07.2	36.8	95 26.9	32.3	86 42.2	53.3	294 13.7	50.7	171 49.9	95	12 19.9	+149
21	152 48.3	132 11.0	·· 36.1	110 27.6	·· 32.8	101 44.1	·· 53.4	309 16.4	·· 50.7	186 18.4	95	·12 05.0	+150
22	167 50.7	147 14.9	35.3	125 28.3	33.4	116 46.0	53.5	324 19.0	50.6	200 46.9	96	11 50.0	+151
23	182 53.2	162 18.7	34.5	140 29.0	33.9	131 48.0	53.7	339 21.6	50.5	215 15.5	96	11 34.9	+152
24	197 55.6	177 22.5	+16 33.7	155 29.7	+16 34.5	146 49.9	+17 53.8	354 24.3	− 6 50.4	229 44.1	96	−11 19.7	+152
code	−	+ 38	− 7	+ 7	+ 5	+ 19	+ 2	+ 26	+ 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
7	0	179 25.1	+ 6 38.0
	1	194 25.3	38.9
	2	209 25.5	39.9
	3	224 25.6	•• 40.8
	4	239 25.8	41.8
	5	254 26.0	42.7
	6	269 26.2	+ 6 43.6
	7	284 26.4	44.6
	8	299 26.5	45.5
	9	314 26.7	•• 46.5
	10	329 26.9	47.4
	11	344 27.1	48.4
	12	359 27.2	+ 6 49.3
	13	14 27.4	50.2
	14	29 27.6	51.2
	15	44 27.8	•• 52.1
	16	59 27.9	53.1
	17	74 28.1	54.0
	18	89 28.3	+ 6 54.9
	19	104 28.5	55.9
	20	119 28.7	56.8
	21	134 28.8	•• 57.7
	22	149 29.0	58.7
	23	164 29.2	6 59.6
8	0	179 29.4	+ 7 00.6
	1	194 29.5	01.5
	2	209 29.7	02.4
	3	224 29.9	•• 03.4
	4	239 30.1	04.3
	5	254 30.2	05.2
	6	269 30.4	+ 7 06.2
	7	284 30.6	07.1
	8	299 30.8	08.1
	9	314 30.9	•• 09.0
	10	329 31.1	09.9
	11	344 31.3	10.9
	12	359 31.5	+ 7 11.8
	13	14 31.6	12.7
	14	29 31.8	13.7
	15	44 32.0	•• 14.6
	16	59 32.2	15.5
	17	74 32.3	16.5
	18	89 32.5	+ 7 17.4
	19	104 32.7	18.3
	20	119 32.9	19.3
	21	134 33.0	•• 20.2
	22	149 33.2	21.1
	23	164 33.4	22.1
9	0	179 33.5	+ 7 23.0
	1	194 33.7	23.9
	2	209 33.9	24.9
	3	224 34.1	•• 25.8
	4	239 34.2	26.7
	5	254 34.4	27.7
	6	269 34.6	+ 7 28.6
	7	284 34.8	29.5
	8	299 34.9	30.5
	9	314 35.1	•• 31.4
	10	329 35.3	32.3
	11	344 35.4	33.2
	12	359 35.6	+ 7 34.2
	13	14 35.8	35.1
	14	29 36.0	36.0
	15	44 36.1	•• 37.0
	16	59 36.3	37.9
	17	74 36.5	38.8
	18	89 36.6	+ 7 39.8
	19	104 36.8	40.7
	20	119 37.0	41.6
	21	134 37.2	•• 42.5
	22	149 37.3	43.5
	23	164 37.5	44.4
	24	179 37.7	+ 7 45.3
code		—	+ 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.8	−40 29.5
5	Achernar	336 00.7	−57 28.4
30	Acrux	173 59.5	−62 50.6
19	Adhara	255 48.1	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.8	+49 32.5
55	Al Na'ir	28 40.5	−47 11.2
15	Alnilam	276 32.3	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.9	+26 51.9
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.3	+ 8 44.4
2	Ankaa	354 00.5	−42 33.5
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.5	+19 25.2
43	Atria	109 03.7	−68 56.6
22	Avior	234 36.5	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.4	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.5	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.4	−18 14.6
27	Dubhe	194 46.1	+62 00.3
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.9	+51 29.2
54	Enif	34 31.7	+ 9 39.4
56	Fomalhaut	16 13.9	−29 52.2
31	Gacrux	172 51.0	−56 51.3
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.7	−60 09.1
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.6	−34 24.6
40	Kochab	137 16.4	+74 20.5
57	Markab	14 23.6	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.3	−69 31.8
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.2	−26 21.5
52	Peacock	54 30.3	−56 53.1
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.2	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.8
44	Sabik	103 04.2	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.1	−37 04.3
18	Sirius	259 13.6	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.6	−43 14.9
49	Vega	81 09.5	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 7	8	9
h	m s	m s	m s
0	− 2 19.9	− 2 02.9	− 1 46.2
6	− 2 15.6	− 1 58.7	− 1 42.0
12	− 2 11.4	− 1 54.5	− 1 37.9
18	− 2 07.1	− 1 50.3	− 1 33.8
24	− 2 02.9	− 1 46.2	− 1 29.7

Lat.	Sunrise	Twlt. begins	Moonrise 7	8	9	10
N °	h m	h m	h m	h m	h m	h m
72	4 20	////	▬	▬	6 05	5 06
70	4 31	////	▬	▬	5 29	4 51
68	4 41	////	▬	5 49	5 02	4 38
66	4 48	////	▬	5 04	4 42	4 27
64	4 55	1 06	4 49	4 35	4 26	4 19
62	5 00	1 51	4 09	4 12	4 12	4 11
60	5 05	2 17	3 41	3 54	4 00	4 04
58	5 09	2 37	3 20	3 38	3 50	3 59
56	5 13	2 53	3 02	3 25	3 41	3 53
54	5 17	3 06	2 47	3 14	3 33	3 49
52	5 20	3 17	2 34	3 04	3 26	3 44
50	5 22	3 27	2 22	2 54	3 20	3 40
45	5 28	3 46	1 58	2 35	3 06	3 32
40	5 34	4 00	1 38	2 19	2 54	3 25
35	5 38	4 12	1 22	2 06	2 44	3 19
30	5 42	4 21	1 08	1 54	2 36	3 13
20	5 48	4 34	0 44	1 34	2 21	3 04
10	5 54	4 43	0 23	1 17	2 07	2 55
0	5 59	4 50	0 04	1 00	1 55	2 48
10	6 04	4 54	24 44	0 44	1 42	2 40
20	6 09	4 56	24 26	0 26	1 29	2 31
30	6 15	4 55	24 06	0 06	1 14	2 22
35	6 18	4 53	23 54	25 05	1 05	2 16
40	6 22	4 51	23 40	24 54	0 54	2 10
45	6 26	4 48	23 23	24 42	0 42	2 02
50	6 31	4 43	23 03	24 27	0 27	1 53
52	6 33	4 40	22 53	24 20	0 20	1 49
54	6 36	4 36	22 42	24 13	0 13	1 45
56	6 39	4 33	22 30	24 04	0 04	1 39
58	6 42	4 29	22 15	23 54	25 34	1 34
60	6 45	4 24	21 58	23 43	25 27	1 27
S						

Lat.	Sunset	Twlt. ends	Moonset 7	8	9	10
N °	h m	h m	h m	h m	h m	h m
72	19 48	////	▬	▬	10 36	13 27
70	19 36	////	▬	▬	11 11	13 39
68	19 26	////	▬	8 55	11 35	13 49
66	19 18	////	▬	9 39	11 54	13 58
64	19 11	23 13	7 56	10 07	12 09	14 05
62	19 05	22 23	8 35	10 29	12 21	14 11
60	19 00	21 53	9 03	10 47	12 32	14 16
58	18 56	21 33	9 24	11 01	12 41	14 20
56	18 52	21 16	9 41	11 14	12 49	14 24
54	18 49	21 03	9 56	11 24	12 56	14 28
52	18 45	20 50	10 09	11 34	13 02	14 31
50	18 42	20 40	10 20	11 42	13 08	14 34
45	18 36	20 21	10 43	12 00	13 20	14 40
40	18 31	20 06	11 02	12 15	13 30	14 46
35	18 27	19 55	11 17	12 27	13 39	14 50
30	18 23	19 45	11 31	12 38	13 46	14 54
20	18 16	19 31	11 53	12 56	13 59	15 01
10	18 10	19 21	12 13	13 12	14 10	15 07
0	18 05	19 14	12 31	13 27	14 20	15 12
10	18 00	19 10	12 49	13 41	14 30	15 17
20	17 55	19 08	13 08	13 56	14 41	15 23
30	17 49	19 08	13 30	14 14	14 53	15 29
35	17 45	19 09	13 43	14 24	15 00	15 33
40	17 41	19 11	13 58	14 36	15 08	15 37
45	17 37	19 14	14 16	14 49	15 17	15 42
50	17 32	19 19	14 37	15 06	15 28	15 47
52	17 30	19 22	14 47	15 13	15 33	15 50
54	17 27	19 25	14 59	15 22	15 39	15 53
56	17 24	19 28	15 12	15 31	15 45	15 56
58	17 21	19 32	15 27	15 42	15 52	15 59
60	17 17	19 36	15 45	15 54	16 00	16 03
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
7	6 18	12 26	13 41	14 20	0 35
8	7 14	12 20	13 40	14 17	0 31
9	8 08	12 14	13 39	14 14	0 27
10	9 00	12 07	13 37	14 11	0 22

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.5	0.1
30	0.3	0.4	0.0
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb
Add

Alt.	7	8	9
°	′	′	′
0	17.5	18.3	19.2
4	17.5	18.3	19.2
8	17.4	18.3	19.2
12	17.4	18.3	19.2
16	17.4	18.2	19.1
20	17.4	18.2	19.0
24	17.3	18.1	18.9
28	17.3	18.1	18.9
32	17.2	18.0	18.7
36	17.1	17.9	18.6
40	17.1	17.8	18.5
44	17.0	17.7	18.4
48	16.9	17.6	18.2
52	16.8	17.4	18.0
56	16.8	17.3	17.9
60	16.7	17.2	17.7
64	16.6	17.0	17.5
68	16.5	16.9	17.3
72	16.4	16.8	17.1
76	16.3	16.6	16.9
80	16.2	16.5	16.7
84	16.1	16.3	16.5
88	16.0	16.2	16.4
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	7	8	9
°	′	′	′
0	14.5	14.0	13.4
4	14.5	14.0	13.5
8	14.5	14.0	13.5
12	14.5	14.0	13.5
16	14.5	14.1	13.6
20	14.6	14.1	13.7
24	14.6	14.2	13.7
28	14.7	14.2	13.8
32	14.7	14.3	13.9
36	14.8	14.4	14.1
40	14.8	14.5	14.2
44	14.9	14.6	14.3
48	15.0	14.7	14.5
52	15.1	14.9	14.6
56	15.2	15.0	14.8
60	15.3	15.1	15.0
64	15.3	15.3	15.2
68	15.4	15.4	15.3
72	15.5	15.5	15.5
76	15.6	15.7	15.7
80	15.8	15.8	15.9
84	15.9	16.0	16.1
88	15.9	16.1	16.3
90			

Subtract from table, back cover

Last Quarter 7

GMT	♈ GHA	VENUS −3.2 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.4 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
10 0	197 55.6	177 22.5	+16 33.7	155 29.7	+16 34.5	146 49.9	+17 53.8	354 24.3	− 6 50.4	229 44.1	96	−11 19.7	+152
1	212 58.1	192 26.4	32.9	170 30.4	35.0	161 51.8	54.0	9 26.9	50.4	244 12.7	97	11 04.5	+154
2	228 00.6	207 30.2	32.1	185 31.0	35.6	176 53.7	54.1	24 29.6	50.3	258 41.4	97	10 49.1	+154
3	243 03.0	222 34.0	31.3	200 31.7	36.1	191 55.6	54.2	39 32.2	50.2	273 10.1	97	10 33.7	+154
4	258 05.5	237 37.8	30.5	215 32.4	36.7	206 57.5	54.4	54 34.9	50.2	287 38.8	98	10 18.3	+155
5	273 08.0	252 41.7	29.6	230 33.1	37.2	221 59.5	54.5	69 37.5	50.1	302 07.6	98	10 02.8	+157
6	288 10.4	267 45.5	+16 28.8	245 33.8	+16 37.8	237 01.4	+17 54.7	84 40.1	− 6 50.0	316 36.4	98	− 9 47.1	+156
7	303 12.9	282 49.3	28.0	260 34.5	38.3	252 03.3	54.8	99 42.8	50.0	331 05.2	98	9 31.5	+158
8	318 15.4	297 53.1	27.2	275 35.2	38.9	267 05.2	54.9	114 45.4	49.9	345 34.0	99	9 15.7	+158
9	333 17.8	312 57.0	26.4	290 35.9	39.4	282 07.1	55.1	129 48.1	49.8	0 02.9	99	8 59.9	+158
10	348 20.3	328 00.8	25.6	305 36.6	40.0	297 09.0	55.2	144 50.7	49.7	14 31.8	99	8 44.1	+159
11	3 22.7	343 04.6	24.8	320 37.2	40.5	312 10.9	55.4	159 53.4	49.7	29 00.7	99	8 28.2	+160
12	18 25.2	358 08.5	+16 23.9	335 37.9	+16 41.0	327 12.9	+17 55.5	174 56.0	− 6 49.6	43 29.6	100	− 8 12.2	+160
13	33 27.7	13 12.3	23.1	350 38.6	41.6	342 14.8	55.6	189 58.6	49.5	57 58.6	100	7 56.2	+161
14	48 30.1	28 16.1	22.3	5 39.3	42.1	357 16.7	55.8	205 01.3	49.5	72 27.6	100	7 40.1	+162
15	63 32.6	43 20.0	21.5	20 40.0	42.7	12 18.6	55.9	220 03.9	49.4	86 56.6	100	7 23.9	+162
16	78 35.1	58 23.8	20.6	35 40.7	43.2	27 20.5	56.1	235 06.6	49.3	101 25.6	100	7 07.7	+162
17	93 37.5	73 27.6	19.8	50 41.4	43.8	42 22.4	56.2	250 09.2	49.2	115 54.6	101	6 51.5	+163
18	108 40.0	88 31.5	+16 19.0	65 42.1	+16 44.3	57 24.3	+17 56.3	265 11.9	− 6 49.2	130 23.7	100	− 6 35.2	+163
19	123 42.5	103 35.3	18.1	80 42.7	44.9	72 26.3	56.5	280 14.5	49.1	144 52.7	101	6 18.9	+164
20	138 44.9	118 39.1	17.3	95 43.4	45.4	87 28.2	56.6	295 17.1	49.0	159 21.8	101	6 02.5	+165
21	153 47.4	133 43.0	16.5	110 44.1	46.0	102 30.1	56.8	310 19.8	49.0	173 50.9	101	5 46.0	+164
22	168 49.9	148 46.8	15.6	125 44.8	46.5	117 32.0	56.9	325 22.4	48.9	188 20.0	102	5 29.6	+165
23	183 52.3	163 50.6	14.8	140 45.5	47.0	132 33.9	57.1	340 25.1	48.8	202 49.2	101	5 13.1	+166
11 0	198 54.8	178 54.5	+16 13.9	155 46.2	+16 47.6	147 35.8	+17 57.2	355 27.7	− 6 48.7	217 18.3	101	− 4 56.5	+166
1	213 57.2	193 58.3	13.1	170 46.9	48.1	162 37.7	57.3	10 30.4	48.7	231 47.4	102	4 39.9	+166
2	228 59.7	209 02.1	12.2	185 47.6	48.7	177 39.7	57.5	25 33.0	48.6	246 16.6	102	4 23.3	+166
3	244 02.2	224 06.0	11.4	200 48.2	49.2	192 41.6	57.6	40 35.7	48.5	260 45.8	101	4 06.7	+167
4	259 04.6	239 09.8	10.5	215 48.9	49.8	207 43.5	57.8	55 38.3	48.5	275 14.9	102	3 50.0	+167
5	274 07.1	254 13.6	09.7	230 49.6	50.3	222 45.4	57.9	70 40.9	48.4	289 44.1	102	3 33.3	+168
6	289 09.6	269 17.5	+16 08.8	245 50.3	+16 50.8	237 47.3	+17 58.0	85 43.6	− 6 48.3	304 13.3	102	− 3 16.5	+167
7	304 12.0	284 21.3	08.0	260 51.0	51.4	252 49.2	58.2	100 46.2	48.2	318 42.5	101	2 59.8	+168
8	319 14.5	299 25.2	07.1	275 51.7	51.9	267 51.1	58.3	115 48.9	48.2	333 11.6	102	2 43.0	+168
9	334 17.0	314 29.0	06.3	290 52.4	52.5	282 53.0	58.5	130 51.5	48.1	347 40.8	102	2 26.2	+168
10	349 19.4	329 32.8	05.4	305 53.0	53.0	297 55.0	58.6	145 54.2	48.0	2 10.0	102	2 09.4	+169
11	4 21.9	344 36.7	04.6	320 53.7	53.6	312 56.9	58.7	160 56.8	48.0	16 39.2	102	1 52.5	+169
12	19 24.3	359 40.5	+16 03.7	335 54.4	+16 54.1	327 58.8	+17 58.9	175 59.4	− 6 47.9	31 08.4	102	− 1 35.6	+168
13	34 26.8	14 44.3	02.8	350 55.1	54.6	343 00.7	59.0	191 02.1	47.8	45 37.6	102	1 18.8	+169
14	49 29.3	29 48.2	02.0	5 55.8	55.2	358 02.6	59.2	206 04.7	47.8	60 06.8	101	1 01.9	+169
15	64 31.7	44 52.0	01.1	20 56.5	55.7	13 04.5	59.3	221 07.4	47.7	74 35.9	102	0 45.0	+169
16	79 34.2	59 55.8	16 00.2	35 57.2	56.3	28 06.4	59.4	236 10.0	47.6	89 05.1	101	0 28.1	+170
17	94 36.7	74 59.7	15 59.3	50 57.8	56.8	43 08.3	59.6	251 12.7	47.5	103 34.2	102	− 0 11.1	+169
18	109 39.1	90 03.5	+15 58.5	65 58.5	+16 57.3	58 10.3	+17 59.7	266 15.3	− 6 47.5	118 03.4	101	+ 0 05.8	+169
19	124 41.6	105 07.3	57.6	80 59.2	57.9	73 12.2	17 59.9	281 18.0	47.4	132 32.5	102	0 22.7	+169
20	139 44.1	120 11.2	56.7	95 59.9	58.4	88 14.1	18 00.0	296 20.6	47.3	147 01.7	101	0 39.6	+170
21	154 46.5	135 15.0	55.8	111 00.6	58.9	103 16.0	00.1	311 23.2	47.3	161 30.8	101	0 56.6	+169
22	169 49.0	150 18.9	55.0	126 01.3	16 59.5	118 17.9	00.3	326 25.9	47.2	175 59.9	101	1 13.5	+169
23	184 51.5	165 22.7	54.1	141 02.0	17 00.0	133 19.8	00.4	341 28.5	47.1	190 29.0	101	1 30.4	+169
12 0	199 53.9	180 26.5	+15 53.2	156 02.6	+17 00.6	148 21.7	+18 00.6	356 31.2	− 6 47.0	204 58.1	100	+ 1 47.3	+169
1	214 56.4	195 30.4	52.3	171 03.3	01.1	163 23.6	00.7	11 33.8	47.0	219 27.1	101	2 04.2	+169
2	229 58.8	210 34.2	51.4	186 04.0	01.6	178 25.5	00.8	26 36.5	46.9	233 56.2	100	2 21.1	+169
3	245 01.3	225 38.0	50.5	201 04.7	02.2	193 27.5	01.0	41 39.1	46.8	248 25.2	100	2 38.0	+169
4	260 03.8	240 41.9	49.7	216 05.4	02.7	208 29.4	01.1	56 41.7	46.8	262 54.2	100	2 54.9	+169
5	275 06.2	255 45.7	48.8	231 06.1	03.2	223 31.3	01.3	71 44.4	46.7	277 23.2	100	3 11.8	+168
6	290 08.7	270 49.5	+15 47.9	246 06.7	+17 03.8	238 33.2	+18 01.4	86 47.0	− 6 46.6	291 52.2	99	+ 3 28.6	+168
7	305 11.2	285 53.4	47.0	261 07.4	04.3	253 35.1	01.6	101 49.7	46.5	306 21.1	99	3 45.4	+168
8	320 13.6	300 57.2	46.1	276 08.1	04.8	268 37.0	01.7	116 52.3	46.5	320 50.0	99	4 02.2	+168
9	335 16.1	316 01.0	45.2	291 08.8	05.4	283 38.9	01.8	131 55.0	46.4	335 18.9	99	4 19.0	+168
10	350 18.6	331 04.9	44.3	306 09.5	05.9	298 40.8	02.0	146 57.6	46.3	349 47.8	98	4 35.8	+167
11	5 21.0	346 08.7	43.4	321 10.2	06.4	313 42.7	02.1	162 00.3	46.3	4 16.6	98	4 52.5	+167
12	20 23.5	1 12.5	+15 42.5	336 10.9	+17 07.0	328 44.7	+18 02.3	177 02.9	− 6 46.2	18 45.4	98	+ 5 09.2	+167
13	35 25.9	16 16.4	41.6	351 11.5	07.5	343 46.6	02.4	192 05.5	46.1	33 14.2	98	5 25.9	+166
14	50 28.4	31 20.2	40.7	6 12.2	08.0	358 48.5	02.5	207 08.2	46.1	47 43.0	97	5 42.5	+166
15	65 30.9	46 24.0	39.8	21 12.9	08.6	13 50.4	02.7	222 10.8	46.0	62 11.7	97	5 59.1	+166
16	80 33.3	61 27.8	38.9	36 13.6	09.1	28 52.3	02.8	237 13.5	45.9	76 40.4	97	6 15.7	+165
17	95 35.8	76 31.7	38.0	51 14.3	09.6	43 54.2	03.0	252 16.1	45.8	91 09.1	96	6 32.2	+165
18	110 38.3	91 35.5	+15 37.0	66 15.0	+17 10.2	58 56.1	+18 03.1	267 18.8	− 6 45.8	105 37.7	96	+ 6 48.7	+164
19	125 40.7	106 39.3	36.1	81 15.6	10.7	73 58.0	03.2	282 21.4	45.7	120 06.3	96	7 05.1	+164
20	140 43.2	121 43.2	35.2	96 16.3	11.2	88 59.9	03.4	297 24.0	45.6	134 34.9	95	7 21.5	+164
21	155 45.7	136 47.0	34.3	111 17.0	11.8	104 01.8	03.5	312 26.7	45.6	149 03.4	95	7 37.9	+163
22	170 48.1	151 50.8	33.4	126 17.7	12.3	119 03.7	03.7	327 29.3	45.5	163 31.9	94	7 54.2	+163
23	185 50.6	166 54.7	32.5	141 18.4	12.8	134 05.7	03.8	342 32.0	45.4	178 00.3	94	8 10.5	+162
24	200 53.1	181 58.5	+15 31.6	156 19.1	+17 13.4	149 07.6	+18 03.9	357 34.6	− 6 45.3	192 28.7	94	+ 8 26.7	+161
code	−	+ 38	− 9	+ 7	+ 5	+ 19	+ 1	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
10 0	179 37.7	+ 7 45.3
1	194 37.8	46.3
2	209 38.0	47.2
3	224 38.2	48.1
4	239 38.3	49.0
5	254 38.5	50.0
6	269 38.7	+ 7 50.9
7	284 38.9	51.8
8	299 39.0	52.7
9	314 39.2	53.7
10	329 39.4	54.6
11	344 39.5	55.5
12	359 39.7	+ 7 56.4
13	14 39.9	57.4
14	29 40.0	58.3
15	44 40.2	+ 7 59.2
16	59 40.4	8 00.1
17	74 40.5	01.1
18	89 40.7	+ 8 02.0
19	104 40.9	02.9
20	119 41.0	03.8
21	134 41.2	04.7
22	149 41.4	05.7
23	164 41.6	06.6
11 0	179 41.7	+ 8 07.5
1	194 41.9	08.4
2	209 42.1	09.4
3	224 42.2	10.3
4	239 42.4	11.2
5	254 42.6	12.1
6	269 42.7	+ 8 13.0
7	284 42.9	14.0
8	299 43.1	14.9
9	314 43.2	15.8
10	329 43.4	16.7
11	344 43.6	17.6
12	359 43.7	+ 8 18.6
13	14 43.9	19.5
14	29 44.0	20.4
15	44 44.2	21.3
16	59 44.4	22.2
17	74 44.5	23.2
18	89 44.7	+ 8 24.1
19	104 44.9	25.0
20	119 45.0	25.9
21	134 45.2	26.8
22	149 45.4	27.7
23	164 45.5	28.7
12 0	179 45.7	+ 8 29.6
1	194 45.9	30.5
2	209 46.0	31.4
3	224 46.2	32.3
4	239 46.4	33.2
5	254 46.5	34.1
6	269 46.7	+ 8 35.1
7	284 46.8	36.0
8	299 47.0	36.9
9	314 47.2	37.8
10	329 47.3	38.7
11	344 47.5	39.6
12	359 47.7	+ 8 40.5
13	14 47.8	41.5
14	29 48.0	42.4
15	44 48.1	43.3
16	59 48.3	44.2
17	74 48.5	45.1
18	89 48.6	+ 8 46.0
19	104 48.8	46.9
20	119 49.0	47.8
21	134 49.1	48.8
22	149 49.3	49.7
23	164 49.4	50.6
24	179 49.6	+ 8 51.5
code	−	+ 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.9	−40 29.5
5	Achernar	336 00.7	−57 28.4
30	Acrux	173 59.5	−62 50.7
19	Adhara	255 48.1	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.5
55	Al Na'ir	28 40.5	−47 11.2
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.9	+26 51.9
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.3	+ 8 44.4
2	Ankaa	354 00.4	−42 33.5
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.5	+19 25.2
43	Atria	109 03.6	−68 56.6
22	Avior	234 36.6	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.4	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.5	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.4	−18 14.6
27	Dubhe	194 46.1	+62 00.3
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.9	+51 29.2
54	Enif	34 31.6	+ 9 39.4
56	Fomalhaut	16 13.9	−29 52.2
31	Gacrux	172 51.0	−56 51.3
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.7	−60 09.1
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.6	−34 24.6
40	Kochab	137 16.4	+74 20.5
57	Markab	14 23.6	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.7
24	Miapl'dus	221 49.3	−69 31.8
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.2	−26 21.5
52	Peacock	54 30.3	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.2	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.8
44	Sabik	103 04.2	−15 40.3
3	Schedar	350 32.9	+56 16.9
45	Shaula	97 23.1	−37 04.4
18	Sirius	259 13.6	−16 39.2
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.6	−43 14.9
49	Vega	81 09.5	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.2

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 10 h m	11 h m	12 h m	13 h m
72	4 03	////	5 06	4 28	3 55	3 18
70	4 17	////	4 51	4 23	3 58	3 32
68	4 28	////	4 38	4 19	4 01	3 43
66	4 37	////	4 27	4 15	4 04	3 52
64	4 44	////	4 19	4 12	4 06	4 00
62	4 51	1 27	4 11	4 09	4 08	4 07
60	4 56	2 00	4 04	4 07	4 10	4 12
58	5 01	2 24	3 59	4 05	4 11	4 18
56	5 05	2 41	3 53	4 03	4 12	4 22
54	5 09	2 56	3 49	4 01	4 14	4 27
52	5 13	3 08	3 44	4 00	4 15	4 31
50	5 16	3 19	3 40	3 58	4 16	4 34
45	5 23	3 40	3 32	3 55	4 18	4 42
40	5 29	3 55	3 25	3 53	4 20	4 48
35	5 34	4 07	3 19	3 50	4 22	4 54
30	5 38	4 17	3 13	3 48	4 23	4 59
20	5 46	4 31	3 04	3 45	4 26	5 07
10	5 52	4 41	2 55	3 42	4 28	5 15
0	5 58	4 49	2 48	3 39	4 30	5 22
10	6 04	4 54	2 40	3 36	4 32	5 29
20	6 10	4 56	2 31	3 33	4 35	5 37
30	6 17	4 56	2 22	3 30	4 38	5 46
35	6 20	4 56	2 16	3 28	4 39	5 52
40	6 25	4 54	2 10	3 25	4 41	5 58
45	6 30	4 52	2 02	3 23	4 43	6 05
50	6 36	4 47	1 53	3 20	4 46	6 13
52	6 39	4 45	1 49	3 18	4 47	6 17
54	6 42	4 42	1 45	3 17	4 49	6 22
56	6 45	4 39	1 39	3 15	4 50	6 27
58	6 49	4 35	1 34	3 13	4 52	6 32
60	6 53	4 31	1 27	3 11	4 54	6 38
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 10 h m	11 h m	12 h m	13 h m
72	20 03	////	13 27	15 55	18 24	21 11
70	19 48	////	13 39	15 56	18 13	20 41
68	19 37	////	13 49	15 57	18 05	20 20
66	19 28	////	13 58	15 58	17 58	20 03
64	19 20	////	14 05	15 58	17 52	19 49
62	19 14	22 47	14 11	15 59	17 47	19 38
60	19 08	22 10	14 16	15 59	17 43	19 28
58	19 03	21 45	14 20	15 59	17 39	19 20
56	18 58	21 26	14 24	16 00	17 36	19 13
54	18 54	21 11	14 28	16 00	17 32	19 06
52	18 51	20 59	14 31	16 00	17 30	19 00
50	18 47	20 47	14 34	16 00	17 27	18 55
45	18 40	20 26	14 40	16 01	17 22	18 44
40	18 34	20 10	14 46	16 01	17 17	18 34
35	18 29	19 57	14 50	16 02	17 14	18 27
30	18 25	19 48	14 54	16 02	17 10	18 20
20	18 17	19 32	15 01	16 02	17 04	18 08
10	18 10	19 21	15 07	16 03	16 59	17 57
0	18 04	19 13	15 12	16 03	16 55	17 47
10	17 59	19 09	15 17	16 03	16 50	17 38
20	17 52	19 05	15 23	16 04	16 45	17 27
30	17 45	19 05	15 29	16 04	16 39	17 16
35	17 41	19 05	15 33	16 04	16 36	17 09
40	17 37	19 07	15 37	16 04	16 32	17 01
45	17 32	19 09	15 42	16 05	16 28	16 52
50	17 26	19 13	15 47	16 05	16 22	16 42
52	17 23	19 15	15 50	16 05	16 20	16 37
54	17 20	19 18	15 53	16 05	16 18	16 31
56	17 16	19 20	15 56	16 05	16 15	16 25
58	17 13	19 24	15 59	16 05	16 12	16 19
60	17 09	19 28	16 03	16 06	16 08	16 11
S						

GMT h	Equation of Time (App.—Mean) 10 m s	11 m s	12 m s
0	− 1 29.7	− 1 13.5	− 0 57.5
6	− 1 25.6	− 1 09.5	− 0 53.6
12	− 1 21.5	− 1 05.5	− 0 49.7
18	− 1 17.5	− 1 01.5	− 0 45.8
24	− 1 13.5	− 0 57.5	− 0 41.9

GMT of Transit
Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
10	9 00	12 07	13 37	14 11	0 22
11	9 51	12 01	13 36	14 08	0 18
12	10 42	11 55	13 35	14 05	0 14
13	11 35	11 49	13 34	14 02	0 10

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.3	0.5	0.1
30	0.3	0.4	0.0
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb
Add

Alt. °	10 ′	11 ′	12 ′
0	19.9	20.3	20.4
4	19.9	20.2	20.4
8	19.8	20.2	20.3
12	19.8	20.1	20.3
16	19.7	20.1	20.2
20	19.6	20.0	20.1
24	19.5	19.9	20.0
28	19.4	19.8	19.9
32	19.3	19.6	19.7
36	19.2	19.5	19.6
40	19.0	19.3	19.4
44	18.8	19.1	19.2
48	18.7	18.9	19.0
52	18.5	18.7	18.8
56	18.3	18.5	18.6
60	18.1	18.3	18.4
64	17.9	18.1	18.1
68	17.6	17.8	17.9
72	17.4	17.6	17.6
76	17.2	17.3	17.4
80	17.0	17.1	17.1
84	16.7	16.8	16.9
88	16.5	16.6	16.7
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt. °	10 ′	11 ′	12 ′
0	13.1	12.9	12.8
4	13.1	12.9	12.8
8	13.1	12.9	12.8
12	13.2	13.0	12.9
16	13.2	13.0	13.0
20	13.3	13.1	13.1
24	13.4	13.2	13.2
28	13.5	13.4	13.3
32	13.7	13.5	13.4
36	13.8	13.6	13.6
40	13.9	13.8	13.8
44	14.1	14.0	13.9
48	14.3	14.2	14.1
52	14.5	14.4	14.3
56	14.7	14.6	14.6
60	14.9	14.8	14.8
64	15.1	15.1	15.0
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.0	16.0	16.1
84	16.2	16.3	16.3
88	16.4	16.5	16.5
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.1 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.4 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
13 0	200 53.1	181 58.5	+15 31.6	156 19.1	+17 13.4	149 07.6	+18 03.9	357 34.6	− 6 45.3	192 28.7	94	+ 8 26.7	+161
1	215 55.5	197 02.3	30.6	171 19.7	13.9	164 09.5	04.1	12 37.3	45.3	206 57.1	93	8 42.8	+161
2	230 58.0	212 06.1	29.7	186 20.4	14.4	179 11.4	04.2	27 39.9	45.2	221 25.4	93	8 58.9	+161
3	246 00.4	227 10.0	•• 28.8	201 21.1	•• 14.9	194 13.3	•• 04.4	42 42.6	•• 45.1	235 53.7	93	• 9 15.0	+159
4	261 02.9	242 13.8	27.9	216 21.8	15.5	209 15.2	04.5	57 45.2	45.1	250 22.0	92	9 30.9	+160
5	276 05.4	257 17.6	26.9	231 22.5	16.0	224 17.1	04.6	72 47.8	45.0	264 50.2	92	9 46.9	+158
6	291 07.8	272 21.4	+15 26.0	246 23.1	+17 16.5	239 19.0	+18 04.8	87 50.5	− 6 44.9	279 18.4	91	+10 02.7	+158
7	306 10.3	287 25.2	25.1	261 23.8	17.1	254 20.9	04.9	102 53.1	44.8	293 46.5	90	10 18.5	+157
8	321 12.8	302 29.1	24.2	276 24.5	17.6	269 22.8	05.1	117 55.8	44.8	308 14.5	91	10 34.2	+157
9	336 15.2	317 32.9	•• 23.2	291 25.2	•• 18.1	284 24.7	•• 05.2	132 58.4	•• 44.7	322 42.6	90	•10 49.9	+156
10	351 17.7	332 36.7	22.3	306 25.9	18.6	299 26.6	05.3	148 01.1	44.6	337 10.6	89	11 05.5	+155
11	6 20.2	347 40.5	21.4	321 26.6	19.2	314 28.5	05.5	163 03.7	44.6	351 38.5	89	11 21.0	+155
12	21 22.6	2 44.3	+15 20.4	336 27.2	+17 19.7	329 30.5	+18 05.6	178 06.3	− 6 44.5	6 06.4	88	+11 36.5	+153
13	36 25.1	17 48.1	19.5	351 27.9	20.2	344 32.4	05.8	193 09.0	44.4	20 34.2	88	11 51.8	+153
14	51 27.6	32 52.0	18.6	6 28.6	20.8	359 34.3	05.9	208 11.6	44.4	35 02.0	88	12 07.1	+152
15	66 30.0	47 55.8	•• 17.6	21 29.3	•• 21.3	14 36.2	•• 06.0	223 14.3	•• 44.3	49 29.8	86	•12 22.3	+151
16	81 32.5	62 59.6	16.7	36 30.0	21.8	29 38.1	06.2	238 16.9	44.2	63 57.4	87	12 37.4	+151
17	96 34.9	78 03.4	15.7	51 30.6	22.3	44 40.0	06.3	253 19.6	44.1	78 25.1	86	12 52.5	+149
18	111 37.4	93 07.2	+15 14.8	66 31.3	+17 22.9	59 41.9	+18 06.5	268 22.2	− 6 44.1	92 52.7	85	+13 07.4	+149
19	126 39.9	108 11.0	13.9	81 32.0	23.4	74 43.8	06.6	283 24.9	44.0	107 20.2	85	13 22.3	+148
20	141 42.3	123 14.8	12.9	96 32.7	23.9	89 45.7	06.7	298 27.5	43.9	121 47.7	84	13 37.1	+147
21	156 44.8	138 18.7	•• 12.0	111 33.4	•• 24.4	104 47.6	•• 06.9	313 30.1	•• 43.9	136 15.1	84	•13 51.8	+146
22	171 47.3	153 22.5	11.0	126 34.0	25.0	119 49.5	07.0	328 32.8	43.8	150 42.5	84	14 06.4	+145
23	186 49.7	168 26.3	10.1	141 34.7	25.5	134 51.4	07.2	343 35.4	43.7	165 09.9	82	14 20.9	+144
14 0	201 52.2	183 30.1	+15 09.1	156 35.4	+17 26.0	149 53.3	+18 07.3	358 38.1	− 6 43.6	179 37.1	83	+14 35.3	+143
1	216 54.7	198 33.9	08.2	171 36.1	26.5	164 55.2	07.4	13 40.7	43.6	194 04.4	81	14 49.6	+142
2	231 57.1	213 37.7	07.2	186 36.8	27.0	179 57.1	07.6	28 43.4	43.5	208 31.5	81	15 03.8	+141
3	246 59.6	228 41.5	•• 06.3	201 37.4	•• 27.6	194 59.1	•• 07.7	43 46.0	•• 43.4	222 58.6	81	•15 17.9	+140
4	262 02.0	243 45.3	05.3	216 38.1	28.1	210 01.0	07.9	58 48.7	43.4	237 25.7	80	15 31.9	+140
5	277 04.5	258 49.1	04.4	231 38.8	28.6	225 02.9	08.0	73 51.3	43.3	251 52.7	79	15 45.9	+137
6	292 07.0	273 52.9	+15 03.4	246 39.5	+17 29.1	240 04.8	+18 08.1	88 53.9	− 6 43.2	266 19.6	79	+15 59.6	+137
7	307 09.4	288 56.7	02.5	261 40.2	29.7	255 06.7	08.3	103 56.6	43.2	280 46.5	79	16 13.3	+136
8	322 11.9	304 00.5	01.5	276 40.8	30.2	270 08.6	08.4	118 59.2	43.1	295 13.4	78	16 26.9	+135
9	337 14.4	319 04.3	•15 00.5	291 41.5	•• 30.7	285 10.5	•• 08.6	134 01.9	•• 43.0	309 40.2	77	•16 40.4	+133
10	352 16.8	334 08.1	14 59.6	306 42.2	31.2	300 12.4	08.7	149 04.5	42.9	324 06.9	77	16 53.7	+133
11	7 19.3	349 11.9	58.6	321 42.9	31.7	315 14.3	08.8	164 07.2	42.9	338 33.6	76	17 07.0	+131
12	22 21.8	4 15.7	+14 57.7	336 43.6	+17 32.3	330 16.2	+18 09.0	179 09.8	− 6 42.8	353 00.2	76	+17 20.1	+130
13	37 24.2	19 19.5	56.7	351 44.2	32.8	345 18.1	09.1	194 12.5	42.7	7 26.8	75	17 33.1	+129
14	52 26.7	34 23.3	55.7	6 44.9	33.3	0 20.0	09.3	209 15.1	42.7	21 53.3	74	17 46.0	+128
15	67 29.2	49 27.1	•• 54.8	21 45.6	•• 33.8	15 21.9	•• 09.4	224 17.7	•• 42.6	36 19.7	74	•17 58.8	+126
16	82 31.6	64 30.9	53.8	36 46.3	34.3	30 23.8	09.5	239 20.4	42.5	50 46.1	74	18 11.4	+125
17	97 34.1	79 34.7	52.8	51 47.0	34.9	45 25.7	09.7	254 23.0	42.4	65 12.5	73	18 23.9	+124
18	112 36.5	94 38.4	+14 51.9	66 47.6	+17 35.4	60 27.6	+18 09.8	269 25.7	− 6 42.4	79 38.8	72	+18 36.3	+123
19	127 39.0	109 42.2	50.9	81 48.3	35.9	75 29.5	10.0	284 28.3	42.3	94 05.0	72	18 48.6	+121
20	142 41.5	124 46.0	49.9	96 49.0	36.4	90 31.4	10.1	299 31.0	42.2	108 31.2	71	19 00.7	+120
21	157 43.9	139 49.8	•• 49.0	111 49.7	•• 36.9	105 33.3	•• 10.2	314 33.6	•• 42.2	122 57.3	71	•19 12.7	+119
22	172 46.4	154 53.6	48.0	126 50.4	37.4	120 35.2	10.4	329 36.3	42.1	137 23.4	70	19 24.6	+117
23	187 48.9	169 57.4	47.0	141 51.0	38.0	135 37.1	10.5	344 38.9	42.0	151 49.4	70	19 36.3	+117
15 0	202 51.3	185 01.2	+14 46.0	156 51.7	+17 38.5	150 39.0	+18 10.7	359 41.5	− 6 42.0	166 15.4	69	+19 48.0	+114
1	217 53.8	200 04.9	45.1	171 52.4	39.0	165 40.9	10.8	14 44.2	41.9	180 41.3	69	19 59.4	+114
2	232 56.3	215 08.7	44.1	186 53.1	39.5	180 42.9	10.9	29 46.8	41.8	195 07.2	68	20 10.8	+112
3	247 58.7	230 12.5	•• 43.1	201 53.7	•• 40.0	195 44.8	•• 11.1	44 49.5	•• 41.7	209 33.0	67	•20 22.0	+110
4	263 01.2	245 16.3	42.1	216 54.4	40.5	210 46.7	11.2	59 52.1	41.7	223 58.7	68	20 33.0	+109
5	278 03.7	260 20.0	41.2	231 55.1	41.0	225 48.6	11.4	74 54.8	41.6	238 24.5	66	20 43.9	+108
6	293 06.1	275 23.8	+14 40.2	246 55.8	+17 41.6	240 50.5	+18 11.5	89 57.4	− 6 41.5	252 50.1	67	+20 54.7	+106
7	308 08.6	290 27.6	39.2	261 56.5	42.1	255 52.4	11.6	105 00.0	41.5	267 15.8	65	21 05.3	+105
8	323 11.0	305 31.3	38.2	276 57.1	42.6	270 54.3	11.8	120 02.7	41.4	281 41.3	66	21 15.8	+104
9	338 13.5	320 35.1	•• 37.3	291 57.8	•• 43.1	285 56.2	•• 11.9	135 05.3	•• 41.3	296 06.9	64	•21 26.2	+102
10	353 16.0	335 38.9	36.3	306 58.5	43.6	300 58.1	12.1	150 08.0	41.3	310 32.3	65	21 36.4	+100
11	8 18.4	350 42.6	35.3	321 59.2	44.1	316 00.0	12.2	165 10.6	41.2	324 57.8	64	21 46.4	+ 99
12	23 20.9	5 46.4	+14 34.3	336 59.8	+17 44.6	331 01.9	+18 12.3	180 13.3	− 6 41.1	339 23.2	63	+21 56.3	+ 98
13	38 23.4	20 50.2	33.3	352 00.5	45.2	346 03.8	12.5	195 15.9	41.0	353 48.5	63	22 06.1	+ 96
14	53 25.8	35 53.9	32.3	7 01.2	45.7	1 05.7	12.6	210 18.6	41.0	8 13.8	63	22 15.7	+ 94
15	68 28.3	50 57.7	•• 31.4	22 01.9	•• 46.2	16 07.6	•• 12.8	225 21.2	•• 40.9	22 39.1	62	•22 25.1	+ 93
16	83 30.8	66 01.4	30.4	37 02.5	46.7	31 09.5	12.9	240 23.8	40.8	37 04.3	62	22 34.4	+ 91
17	98 33.2	81 05.2	29.4	52 03.2	47.2	46 11.4	13.0	255 26.5	40.8	51 29.5	61	22 43.5	+ 90
18	113 35.7	96 09.0	+14 28.4	67 03.9	+17 47.7	61 13.3	+18 13.2	270 29.1	− 6 40.7	65 54.6	62	+22 52.5	+ 88
19	128 38.1	111 12.7	27.4	82 04.6	48.2	76 15.2	13.3	285 31.8	40.6	80 19.8	60	23 01.3	+ 87
20	143 40.6	126 16.5	26.4	97 05.3	48.7	91 17.1	13.5	300 34.4	40.5	94 44.8	61	23 10.0	+ 85
21	158 43.1	141 20.2	•• 25.4	112 05.9	•• 49.2	106 19.0	•• 13.6	315 37.1	•• 40.5	109 09.9	60	•23 18.5	+ 84
22	173 45.5	156 24.0	24.4	127 06.6	49.8	121 20.9	13.7	330 39.7	40.4	123 34.9	60	23 26.9	+ 81
23	188 48.0	171 27.7	23.4	142 07.3	50.3	136 22.8	13.9	345 42.4	40.3	137 59.9	59	23 35.0	+ 81
24	203 50.5	186 31.5	+14 22.4	157 08.0	+17 50.8	151 24.7	+18 14.0	0 45.0	− 6 40.3	152 24.8	59	+23 43.1	+ 78
code	−	+ 38	− 10	+ 6	+ 5	+ 19	+ 1	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
13 0	179 49.6	+ 8 51.5
1	194 49.8	52.4
2	209 49.9	53.3
3	224 50.1	54.2
4	239 50.2	55.1
5	254 50.4	56.0
6	269 50.6	+ 8 56.9
7	284 50.7	57.9
8	299 50.9	58.8
9	314 51.0	8 59.7
10	329 51.2	9 00.6
11	344 51.4	01.5
12	359 51.5	+ 9 02.4
13	14 51.7	03.3
14	29 51.8	04.2
15	44 52.0	05.1
16	59 52.2	06.0
17	74 52.3	06.9
18	89 52.5	+ 9 07.8
19	104 52.6	08.7
20	119 52.8	09.6
21	134 52.9	10.5
22	149 53.1	11.4
23	164 53.3	12.4
14 0	179 53.4	+ 9 13.3
1	194 53.6	14.2
2	209 53.7	15.1
3	224 53.9	16.0
4	239 54.0	16.9
5	254 54.2	17.8
6	269 54.4	+ 9 18.7
7	284 54.5	19.6
8	299 54.7	20.5
9	314 54.8	21.4
10	329 55.0	22.3
11	344 55.1	23.2
12	359 55.3	+ 9 24.1
13	14 55.5	25.0
14	29 55.6	25.9
15	44 55.8	26.8
16	59 55.9	27.7
17	74 56.1	28.6
18	89 56.2	+ 9 29.5
19	104 56.4	30.4
20	119 56.5	31.3
21	134 56.7	32.2
22	149 56.9	33.1
23	164 57.0	34.0
15 0	179 57.2	+ 9 34.9
1	194 57.3	35.8
2	209 57.5	36.7
3	224 57.6	37.6
4	239 57.8	38.5
5	254 57.9	39.4
6	269 58.1	+ 9 40.2
7	284 58.2	41.1
8	299 58.4	42.0
9	314 58.5	42.9
10	329 58.7	43.8
11	344 58.8	44.7
12	359 59.0	+ 9 45.6
13	14 59.1	46.5
14	29 59.3	47.4
15	44 59.5	48.3
16	59 59.6	49.2
17	74 59.8	50.1
18	89 59.9	+ 9 51.0
19	105 00.1	51.9
20	120 00.2	52.8
21	135 00.4	53.7
22	150 00.5	54.5
23	165 00.7	55.4
24	180 00.8	+ 9 56.3
code	−	+ 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.5
5	Achernar	336 00.6	−57 28.3
30	Acrux	173 59.5	−62 50.7
19	Adhara	255 48.1	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.5	−47 11.2
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.9	+26 52.0
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.3	+ 8 44.4
2	Ankaa	354 00.4	−42 33.5
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.5	+19 25.2
43	Atria	109 03.6	−68 56.7
22	Avior	234 36.6	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.4	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.5	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.4	−18 14.6
27	Dubhe	194 46.2	+62 00.3
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.9	+51 29.2
54	Enif	34 31.6	+ 9 39.4
56	Fomalhaut	16 13.9	−29 52.2
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.7	−60 09.1
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.5	−34 24.6
40	Kochab	137 16.3	+74 20.5
57	Markab	14 23.6	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.7
24	Miapl'dus	221 49.4	−69 31.8
9	Mirfak	309 45.6	+49 42.0
50	Nunki	76 54.1	−26 21.5
52	Peacock	54 30.2	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.2	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.6	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.8
44	Sabik	103 04.1	−15 40.3
3	Schedar	350 32.9	+56 16.8
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 13.6	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.7	−43 14.9
49	Vega	81 09.4	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.2

GMT	Equation of Time (App.—Mean) 13	14	15
h	m s	m s	m s
0	− 0 41.9	− 0 26.6	− 0 11.7
6	− 0 38.1	− 0 22.9	− 0 08.0
12	− 0 34.2	− 0 19.1	− 0 04.3
18	− 0 30.4	− 0 15.4	− 0 00.7
24	− 0 26.6	− 0 11.7	+ 0 03.0

Lat.	Sunrise	Twlt. begins	Moonrise 13	14	15	16
N °	h m	h m	h m	h m	h m	h m
72	3 46	////	3 18	2 25	☐	☐
70	4 02	////	3 32	2 57	1 22	☐
68	4 15	////	3 43	3 20	2 40	☐
66	4 25	////	3 52	3 38	3 19	2 20
64	4 34	////	4 00	3 53	3 46	3 34
62	4 41	0 56	4 07	4 06	4 07	4 11
60	4 47	1 41	4 12	4 17	4 24	4 37
58	4 53	2 09	4 18	4 27	4 39	4 58
56	4 58	2 29	4 22	4 35	4 51	5 15
54	5 02	2 46	4 27	4 42	5 02	5 30
52	5 06	2 58	4 31	4 49	5 12	5 43
50	5 10	3 10	4 34	4 55	5 21	5 54
45	5 18	3 32	4 42	5 08	5 39	6 18
40	5 24	3 50	4 48	5 19	5 55	6 37
35	5 30	4 02	4 54	5 28	6 08	6 53
30	5 35	4 13	4 59	5 37	6 19	7 06
20	5 43	4 29	5 07	5 51	6 39	7 30
10	5 50	4 40	5 15	6 04	6 56	7 51
0	5 57	4 47	5 22	6 16	7 12	8 10
10	6 04	4 54	5 29	6 28	7 28	8 30
20	6 11	4 56	5 37	6 41	7 46	8 50
30	6 18	4 58	5 46	6 56	8 06	9 15
35	6 23	4 58	5 52	7 05	8 18	9 29
40	6 28	4 57	5 58	7 15	8 32	9 46
45	6 33	4 54	6 05	7 27	8 49	10 06
50	6 40	4 52	6 13	7 42	9 09	10 31
52	6 44	4 50	6 17	7 49	9 19	10 43
54	6 47	4 47	6 22	7 56	9 30	10 57
56	6 51	4 45	6 27	8 05	9 42	11 14
58	6 55	4 42	6 32	8 14	9 57	11 33
60	7 00	4 39	6 38	8 26	10 14	11 58

Lat.	Sunset	Twlt. ends	Moonset 13	14	15	16
N °	h m	h m	h m	h m	h m	h m
72	20 18	////	21 11	☐	☐	☐
70	20 02	////	20 41	24 14	0 14	☐
68	19 49	////	20 20	22 56	☐	☐
66	19 38	////	20 03	22 19	25 18	1 18
64	19 29	////	19 49	21 53	24 05	0 05
62	19 22	23 22	19 38	21 33	23 29	25 17
60	19 15	22 28	19 28	21 16	23 03	24 39
58	19 09	21 58	19 20	21 02	22 42	24 12
56	19 04	21 37	19 13	20 51	22 26	23 51
54	19 00	21 20	19 06	20 40	22 11	23 34
52	18 56	21 07	19 00	20 31	21 59	23 19
50	18 52	20 54	18 55	20 23	21 48	23 06
45	18 44	20 31	18 44	20 06	21 26	22 39
40	18 37	20 14	18 34	19 52	21 08	22 19
35	18 31	20 00	18 27	19 40	20 52	22 01
30	18 26	19 49	18 20	19 30	20 39	21 46
20	18 18	19 33	18 08	19 12	20 17	21 21
10	18 10	19 21	17 57	18 57	19 58	20 59
0	18 04	19 14	17 47	18 42	19 40	20 38
10	17 57	19 07	17 38	18 28	19 22	20 18
20	17 50	19 04	17 27	18 13	19 02	19 56
30	17 42	19 02	17 16	17 56	18 41	19 31
35	17 37	19 01	17 09	17 46	18 28	19 16
40	17 32	19 02	17 01	17 34	18 13	18 59
45	17 26	19 04	16 52	17 21	17 55	18 38
50	17 19	19 07	16 42	17 05	17 34	18 12
52	17 16	19 08	16 37	16 57	17 24	18 00
54	17 13	19 11	16 31	16 49	17 12	17 45
56	17 09	19 13	16 25	16 39	16 59	17 29
58	17 05	19 16	16 19	16 29	16 44	17 09
60	17 00	19 19	16 11	16 17	16 26	16 44

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
13	11 35	11 49	13 34	14 02	0 10
14	12 29	11 43	13 33	13 59	0 06
15	13 26	11 37	13 32	13 56	{0 01 / 23 57}
16	14 24	11 31	13 31	13 53	23 53

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.5	0.1
30	0.3	0.4	0.0
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	13	14	15
°	′	′	′
0	20.1	19.5	18.6
4	20.1	19.5	18.6
8	20.1	19.5	18.6
12	20.0	19.4	18.5
16	20.0	19.3	18.5
20	19.9	19.3	18.4
24	19.8	19.2	18.4
28	19.7	19.1	18.3
32	19.5	19.0	18.2
36	19.4	18.8	18.1
40	19.2	18.7	18.0
44	19.0	18.5	17.9
48	18.8	18.4	17.7
52	18.6	18.2	17.6
56	18.4	18.0	17.5
60	18.2	17.9	17.3
64	18.0	17.7	17.2
68	17.8	17.5	17.0
72	17.5	17.2	16.9
76	17.3	17.0	16.7
80	17.0	16.8	16.5
84	16.8	16.6	16.4
88	16.6	16.4	16.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	13	14	15
°	′	′	′
0	12.9	13.3	13.8
4	13.0	13.3	13.8
8	13.0	13.3	13.8
12	13.0	13.4	13.9
16	13.1	13.4	13.9
20	13.2	13.5	14.0
24	13.3	13.6	14.0
28	13.4	13.7	14.1
32	13.5	13.8	14.2
36	13.7	14.0	14.3
40	13.9	14.1	14.4
44	14.0	14.2	14.5
48	14.2	14.4	14.7
52	14.4	14.6	14.8
56	14.6	14.8	14.9
60	14.8	14.9	15.1
64	15.1	15.1	15.2
68	15.3	15.3	15.4
72	15.5	15.5	15.5
76	15.8	15.7	15.7
80	16.0	16.0	15.9
84	16.3	16.2	16.0
88	16.5	16.3	16.2
90			

Subtract from table, back cover

New Moon 13

GMT	♈ GHA	VENUS −3.2 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.4 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
16 0	203 50.5	186 31.5	+14 22.4	157 08.0	+17 50.8	151 24.7	+18 14.0	0 45.0	− 6 40.3	152 24.8	59	+23 43.1	+ 78
1	218 52.9	201 35.2	21.5	172 08.6	51.3	166 26.6	14.2	15 47.6	40.2	166 49.7	59	23 50.9	+ 77
2	233 55.4	216 38.9	20.5	187 09.3	51.8	181 28.5	14.3	30 50.3	40.1	181 14.6	59	23 58.6	+ 76
3	248 57.9	231 42.7	•• 19.5	202 10.0	•• 52.3	196 30.4	•• 14.4	45 52.9	•• 40.1	195 39.5	58	•24 06.2	+ 74
4	264 00.3	246 46.4	18.5	217 10.7	52.8	211 32.3	14.6	60 55.6	40.0	210 04.3	58	24 13.6	+ 72
5	279 02.8	261 50.1	17.5	232 11.3	53.3	226 34.2	14.7	75 58.2	39.9	224 29.1	58	24 20.8	+ 70
6	294 05.3	276 53.9	+14 16.5	247 12.0	+17 53.8	241 36.1	+18 14.9	91 00.9	− 6 39.8	238 53.9	58	+24 27.8	+ 69
7	309 07.7	291 57.6	15.5	262 12.7	54.3	256 38.0	15.0	106 03.5	39.8	253 18.7	57	24 34.7	+ 67
8	324 10.2	307 01.3	14.5	277 13.4	54.8	271 39.9	15.1	121 06.2	39.7	267 43.4	58	24 41.4	+ 66
9	339 12.6	322 05.1	•• 13.5	292 14.0	•• 55.3	286 41.8	•• 15.3	136 08.8	•• 39.6	282 08.2	57	•24 48.0	+ 64
10	354 15.1	337 08.8	12.5	307 14.7	55.9	301 43.7	15.4	151 11.4	39.6	296 32.9	57	24 54.4	+ 62
11	9 17.6	352 12.5	11.5	322 15.4	56.4	316 45.6	15.5	166 14.1	39.5	310 57.6	57	25 00.6	+ 61
12	24 20.0	7 16.2	+14 10.5	337 16.1	+17 56.9	331 47.5	+18 15.7	181 16.7	− 6 39.4	325 22.3	57	+25 06.7	+ 58
13	39 22.5	22 20.0	09.5	352 16.7	57.4	346 49.4	15.8	196 19.4	39.4	339 47.0	56	25 12.5	+ 58
14	54 25.0	37 23.7	08.5	7 17.4	57.9	1 51.3	16.0	211 22.0	39.3	354 11.6	57	25 18.3	+ 55
15	69 27.4	52 27.4	•• 07.5	22 18.1	•• 58.4	16 53.2	•• 16.1	226 24.7	•• 39.2	8 36.3	57	•25 23.8	+ 54
16	84 29.9	67 31.1	06.5	37 18.8	58.9	31 55.1	16.2	241 27.3	39.1	23 01.0	56	25 29.2	+ 52
17	99 32.4	82 34.8	05.5	52 19.4	59.4	46 57.0	16.4	256 30.0	39.1	37 25.6	57	25 34.4	+ 50
18	114 34.8	97 38.5	+14 04.5	67 20.1	+17 59.9	61 58.9	+18 16.5	271 32.6	− 6 39.0	51 50.3	56	+25 39.4	+ 49
19	129 37.3	112 42.3	03.5	82 20.8	18 00.4	77 00.8	16.7	286 35.2	38.9	66 14.9	56	25 44.3	+ 47
20	144 39.8	127 46.0	02.5	97 21.5	00.9	92 02.7	16.8	301 37.9	38.9	80 39.5	57	25 49.0	+ 46
21	159 42.2	142 49.7	•• 01.5	112 22.1	•• 01.4	107 04.6	•• 16.9	316 40.5	•• 38.8	95 04.2	56	•25 53.6	+ 43
22	174 44.7	157 53.4	14 00.5	127 22.8	01.9	122 06.5	17.1	331 43.2	38.7	109 28.8	57	25 57.9	+ 42
23	189 47.1	172 57.1	13 59.5	142 23.5	02.4	137 08.4	17.2	346 45.8	38.7	123 53.5	57	26 02.1	+ 40
17 0	204 49.6	188 00.8	+13 58.5	157 24.2	+18 02.9	152 10.3	+18 17.4	1 48.5	− 6 38.6	138 18.2	57	+26 06.1	+ 39
1	219 52.1	203 04.5	57.5	172 24.8	03.4	167 12.2	17.5	16 51.1	38.5	152 42.9	56	26 10.0	+ 37
2	234 54.5	218 08.2	56.5	187 25.5	03.9	182 14.1	17.6	31 53.7	38.5	167 07.5	57	26 13.7	+ 35
3	249 57.0	233 11.9	•• 55.4	202 26.2	•• 04.4	197 16.0	•• 17.8	46 56.4	•• 38.4	181 32.2	58	•26 17.2	+ 33
4	264 59.5	248 15.6	54.4	217 26.9	04.9	212 17.9	17.9	61 59.0	38.3	195 57.0	57	26 20.5	+ 32
5	280 01.9	263 19.3	53.4	232 27.5	05.4	227 19.8	18.1	77 01.7	38.2	210 21.7	57	26 23.7	+ 30
6	295 04.4	278 22.9	+13 52.4	247 28.2	+18 05.9	242 21.7	+18 18.2	92 04.3	− 6 38.2	224 46.4	58	+26 26.7	+ 29
7	310 06.9	293 26.6	51.4	262 28.9	06.4	257 23.6	18.3	107 07.0	38.1	239 11.2	58	26 29.6	+ 26
8	325 09.3	308 30.3	50.4	277 29.6	06.9	272 25.5	18.5	122 09.6	38.0	253 36.0	58	26 32.2	+ 25
9	340 11.8	323 34.0	•• 49.4	292 30.2	•• 07.4	287 27.4	•• 18.6	137 12.3	•• 38.0	268 00.8	59	•26 34.7	+ 23
10	355 14.2	338 37.7	48.4	307 30.9	07.9	302 29.3	18.8	152 14.9	37.9	282 25.7	58	26 37.0	+ 22
11	10 16.7	353 41.3	47.4	322 31.6	08.4	317 31.2	18.9	167 17.5	37.8	296 50.5	60	26 39.2	+ 20
12	25 19.2	8 45.0	+13 46.4	337 32.2	+18 08.9	332 33.1	+18 19.0	182 20.2	− 6 37.8	311 15.5	59	+26 41.2	+ 18
13	40 21.6	23 48.7	45.4	352 32.9	09.4	347 35.0	19.2	197 22.8	37.7	325 40.4	60	26 43.0	+ 17
14	55 24.1	38 52.4	44.4	7 33.6	09.9	2 36.9	19.3	212 25.5	37.6	340 05.4	60	26 44.7	+ 15
15	70 26.6	53 56.0	•• 43.3	22 34.3	•• 10.4	17 38.8	•• 19.4	227 28.1	•• 37.5	354 30.4	60	•26 46.2	+ 13
16	85 29.0	68 59.7	42.3	37 34.9	10.9	32 40.7	19.6	242 30.8	37.5	8 55.4	61	26 47.5	+ 12
17	100 31.5	84 03.4	41.3	52 35.6	11.4	47 42.6	19.7	257 33.4	37.4	23 20.5	61	26 48.7	+ 10
18	115 34.0	99 07.0	+13 40.3	67 36.3	+18 11.9	62 44.5	+18 19.9	272 36.1	− 6 37.3	37 45.6	61	+26 49.7	+ 8
19	130 36.4	114 10.7	39.3	82 37.0	12.4	77 46.4	20.0	287 38.7	37.3	52 10.7	62	26 50.5	+ 7
20	145 38.9	129 14.4	38.3	97 37.6	12.9	92 48.3	20.1	302 41.3	37.2	66 35.9	63	26 51.2	+ 5
21	160 41.4	144 18.0	•• 37.3	112 38.3	•• 13.4	107 50.2	•• 20.3	317 44.0	•• 37.1	81 01.2	63	•26 51.7	+ 3
22	175 43.8	159 21.7	36.3	127 39.0	13.9	122 52.1	20.4	332 46.6	37.1	95 26.5	63	26 52.0	+ 2
23	190 46.3	174 25.3	35.2	142 39.6	14.4	137 53.9	20.6	347 49.3	37.0	109 51.8	64	26 52.2	0
18 0	205 48.7	189 29.0	+13 34.2	157 40.3	+18 14.9	152 55.8	+18 20.7	2 51.9	− 6 36.9	124 17.2	65	+26 52.2	− 2
1	220 51.2	204 32.6	33.2	172 41.0	15.4	167 57.7	20.8	17 54.6	36.8	138 42.7	65	26 52.0	− 3
2	235 53.7	219 36.3	32.2	187 41.7	15.9	182 59.6	21.0	32 57.2	36.8	153 08.2	65	26 51.7	− 4
3	250 56.1	234 39.9	•• 31.2	202 42.3	•• 16.4	198 01.5	•• 21.1	47 59.8	•• 36.7	167 33.7	66	•26 51.3	− 7
4	265 58.6	249 43.5	30.2	217 43.0	16.8	213 03.4	21.3	63 02.5	36.6	181 59.3	67	26 50.6	− 7
5	281 01.1	264 47.2	29.2	232 43.7	17.3	228 05.3	21.4	78 05.1	36.6	196 25.0	67	26 49.9	− 10
6	296 03.5	279 50.8	+13 28.2	247 44.3	+18 17.8	243 07.2	+18 21.5	93 07.8	− 6 36.5	210 50.7	68	+26 48.9	− 11
7	311 06.0	294 54.4	27.2	262 45.0	18.3	258 09.1	21.7	108 10.4	36.4	225 16.5	68	26 47.8	− 12
8	326 08.5	309 58.1	26.1	277 45.7	18.8	273 11.0	21.8	123 13.1	36.4	239 42.3	70	26 46.6	− 14
9	341 10.9	325 01.7	•• 25.1	292 46.4	•• 19.3	288 12.9	•• 22.0	138 15.7	•• 36.3	254 08.3	69	•26 45.2	− 16
10	356 13.4	340 05.3	24.1	307 47.0	19.8	303 14.8	22.1	153 18.4	36.2	268 34.2	71	26 43.6	− 17
11	11 15.9	355 08.9	23.1	322 47.7	20.3	318 16.7	22.2	168 21.0	36.2	283 00.3	71	26 41.9	− 19
12	26 18.3	10 12.6	+13 22.1	337 48.4	+18 20.8	333 18.6	+18 22.4	183 23.6	− 6 36.1	297 26.4	72	+26 40.0	− 20
13	41 20.8	25 16.2	21.1	352 49.0	21.3	348 20.5	22.5	198 26.3	36.0	311 52.6	72	26 38.0	− 22
14	56 23.2	40 19.8	20.1	7 49.7	21.8	3 22.4	22.6	213 28.9	35.9	326 18.8	73	26 35.8	− 23
15	71 25.7	55 23.4	•• 19.0	22 50.4	•• 22.3	18 24.3	•• 22.8	228 31.6	•• 35.9	340 45.1	74	•26 33.5	− 25
16	86 28.2	70 27.0	18.0	37 51.1	22.7	33 26.2	22.9	243 34.2	35.8	355 11.5	75	26 31.0	− 26
17	101 30.6	85 30.6	17.0	52 51.7	23.2	48 28.1	23.1	258 36.9	35.7	9 38.0	76	26 28.4	− 27
18	116 33.1	100 34.2	+13 16.0	67 52.4	+18 23.7	63 30.0	+18 23.2	273 39.5	− 6 35.7	24 04.6	76	+26 25.7	− 30
19	131 35.6	115 37.8	15.0	82 53.1	24.2	78 31.9	23.3	288 42.1	35.6	38 31.2	77	26 22.7	− 30
20	146 38.0	130 41.4	14.0	97 53.7	24.7	93 33.8	23.5	303 44.8	35.5	52 57.9	78	26 19.7	− 32
21	161 40.5	145 45.0	•• 13.0	112 54.4	•• 25.2	108 35.7	•• 23.6	318 47.4	•• 35.5	67 24.7	78	•26 16.5	− 33
22	176 43.0	160 48.6	11.9	127 55.1	25.7	123 37.5	23.8	333 50.1	35.4	81 51.5	79	26 13.2	− 35
23	191 45.4	175 52.2	10.9	142 55.7	26.2	138 39.4	23.9	348 52.7	35.3	96 18.4	81	26 09.7	− 36
24	206 47.9	190 55.8	+13 09.9	157 56.4	+18 26.7	153 41.3	+18 24.0	3 55.4	− 6 35.3	110 45.5	81	+26 06.1	− 38
code	−	+ 37	− 10	+ 7	+ 5	+ 19	+ 2	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
16 0h	180 00.8	+ 9 56.3
1	195 01.0	57.2
2	210 01.1	58.1
3	225 01.3	59.0
4	240 01.4	9 59.9
5	255 01.6	10 00.8
6	270 01.7	+10 01.7
7	285 01.9	02.6
8	300 02.0	03.4
9	315 02.2	04.3
10	330 02.3	05.2
11	345 02.5	06.1
12	0 02.6	+10 07.0
13	15 02.8	07.9
14	30 02.9	08.8
15	45 03.1	09.7
16	60 03.2	10.5
17	75 03.3	11.4
18	90 03.5	+10 12.3
19	105 03.6	13.2
20	120 03.8	14.1
21	135 03.9	15.0
22	150 04.1	15.8
23	165 04.2	16.7
17 0h	180 04.4	+10 17.6
1	195 04.5	18.5
2	210 04.7	19.4
3	225 04.8	20.3
4	240 05.0	21.1
5	255 05.1	22.0
6	270 05.3	+10 22.9
7	285 05.4	23.8
8	300 05.5	24.7
9	315 05.7	25.6
10	330 05.8	26.4
11	345 06.0	27.3
12	0 06.1	+10 28.2
13	15 06.3	29.1
14	30 06.4	30.0
15	45 06.6	30.8
16	60 06.7	31.7
17	75 06.9	32.6
18	90 07.0	+10 33.5
19	105 07.1	34.3
20	120 07.3	35.2
21	135 07.4	36.1
22	150 07.6	37.0
23	165 07.7	37.9
18 0h	180 07.9	+10 38.7
1	195 08.0	39.6
2	210 08.1	40.5
3	225 08.3	41.4
4	240 08.4	42.2
5	255 08.6	43.1
6	270 08.7	+10 44.0
7	285 08.8	44.9
8	300 09.0	45.7
9	315 09.1	46.6
10	330 09.3	47.5
11	345 09.4	48.4
12	0 09.6	+10 49.2
13	15 09.7	50.1
14	30 09.8	51.0
15	45 10.0	51.8
16	60 10.1	52.7
17	75 10.3	53.6
18	90 10.4	+10 54.5
19	105 10.5	55.3
20	120 10.7	56.2
21	135 10.8	57.1
22	150 11.0	57.9
23	165 11.1	58.8
24	180 11.2	+10 59.7
code	−	+ 9

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.9	−40 29.5
5	Achernar	336 00.6	−57 28.3
30	Acrux	173 59.5	−62 50.7
19	Adhara	255 48.1	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.4	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.9	+26 52.0
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.3	+ 8 44.4
2	Ankaa	354 00.4	−42 33.5
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.5	+19 25.2
43	Atria	109 03.5	−68 56.7
22	Avior	234 36.6	−59 21.8
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.4	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.4	+45 06.4
28	Denebola	183 19.3	+14 49.8
4	Diphda	349 41.4	−18 14.5
27	Dubhe	194 46.2	+62 00.3
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.9	+51 29.2
54	Enif	34 31.6	+ 9 39.4
56	Fomalhaut	16 13.9	−29 52.2
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.6	−60 09.1
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.5	−34 24.6
40	Kochab	137 16.3	+74 20.6
57	Markab	14 23.6	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.7
24	Miapl'dus	221 49.4	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.1	−26 21.4
52	Peacock	54 30.2	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.2	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.8
44	Sabik	103 04.1	−15 40.3
3	Schedar	350 32.9	+56 16.8
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 13.6	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.7	−43 14.9
49	Vega	81 09.4	+38 44.0
39	Zub'g'bi	137 55.2	−15 51.2

GMT	Equation of Time (App.—Mean) 16	17	18
h	m s	m s	m s
0	+ 0 03.0	+ 0 17.2	+ 0 31.1
6	+ 0 06.6	+ 0 20.7	+ 0 34.5
12	+ 0 10.1	+ 0 24.2	+ 0 37.9
18	+ 0 13.7	+ 0 27.7	+ 0 41.3
24	+ 0 17.2	+ 0 31.1	+ 0 44.7

Lat.	Sunrise	Twlt. begins	Moonrise 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	3 29	////	▭	▭	▭	▭
70	3 47	////	▭	▭	▭	▭
68	4 02	////	▭	▭	▭	▭
66	4 13	////	2 20	▭	▭	▭
64	4 23	////	3 34	▭	▭	5 31
62	4 31	////	4 11	4 25	5 11	6 36
60	4 38	1 18	4 37	5 04	5 55	7 10
58	4 45	1 53	4 58	5 31	6 24	7 35
56	4 50	2 17	5 15	5 52	6 46	7 55
54	4 55	2 35	5 30	6 10	7 04	8 12
52	5 00	2 49	5 43	6 25	7 20	8 26
50	5 04	3 02	5 54	6 38	7 33	8 38
45	5 13	3 26	6 18	7 05	8 01	9 04
40	5 20	3 44	6 37	7 26	8 23	9 24
35	5 26	3 58	6 53	7 44	8 41	9 41
30	5 31	4 09	7 06	7 59	8 56	9 55
20	5 41	4 26	7 30	8 25	9 23	10 20
10	5 49	4 38	7 51	8 48	9 45	10 42
0	5 56	4 47	8 10	9 09	10 07	11 01
10	6 04	4 53	8 30	9 30	10 28	11 21
20	6 11	4 57	8 50	9 53	10 50	11 42
30	6 20	5 00	9 15	10 19	11 17	12 07
35	6 25	5 00	9 29	10 35	11 32	12 21
40	6 31	5 00	9 46	10 53	11 50	12 38
45	6 37	4 58	10 06	11 15	12 12	12 58
50	6 45	4 56	10 31	11 43	12 40	13 22
52	6 49	4 55	10 43	11 56	12 53	13 34
54	6 53	4 53	10 57	12 12	13 09	13 48
56	6 57	4 51	11 14	12 31	13 27	14 04
58	7 02	4 49	11 33	12 54	13 49	14 22
60	7 07	4 46	11 58	13 24	14 18	14 45
S						

Lat.	Sunset	Twlt. ends	Moonset 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	20 34	////	▭	▭	▭	▭
70	20 15	////	▭	▭	▭	▭
68	20 01	////	▭	▭	▭	▭
66	19 48	////	1 18	▭	▭	▭
64	19 38	////	0 05	▭	▭	4 09
62	19 30	////	25 17	1 17	2 34	3 05
60	19 23	22 51	24 39	0 39	1 50	2 30
58	19 16	22 13	24 12	0 12	1 21	2 05
56	19 10	21 48	23 51	24 58	0 58	1 45
54	19 05	21 29	23 34	24 40	0 40	1 28
52	19 01	21 15	23 19	24 24	0 24	1 13
50	18 57	21 02	23 06	24 11	0 11	1 01
45	18 48	20 37	22 39	23 43	24 35	0 35
40	18 40	20 18	22 19	23 21	24 14	0 14
35	18 34	20 04	22 01	23 03	23 56	24 41
30	18 28	19 52	21 46	22 47	23 41	24 28
20	18 19	19 35	21 21	22 21	23 16	24 05
10	18 11	19 23	20 59	21 58	22 54	23 45
0	18 03	19 13	20 38	21 37	22 33	23 26
10	17 55	19 06	20 18	21 15	22 13	23 08
20	17 47	19 01	19 56	20 53	21 50	22 48
30	17 39	18 59	19 31	20 26	21 24	22 24
35	17 34	18 58	19 16	20 10	21 09	22 10
40	17 28	18 58	18 59	19 52	20 51	21 54
45	17 21	18 59	18 38	19 30	20 30	21 35
50	17 13	19 01	18 12	19 02	20 03	21 11
52	17 10	19 03	18 00	18 48	19 49	20 59
54	17 06	19 04	17 45	18 32	19 34	20 46
56	17 01	19 05	17 29	18 14	19 16	20 31
58	16 56	19 07	17 09	17 51	18 54	20 13
60	16 51	19 10	16 44	17 21	18 25	19 50
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
16	14 24	11 31	13 31	13 53	23 53
17	15 23	11 25	13 30	13 50	23 49
18	16 20	11 19	13 29	13 47	23 44
19	17 14	11 14	13 28	13 44	23 40

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.5	0.1
30	0.3	0.4	0.0
45	0.3	0.3	0.0
60	0.3	0.2	0.0
75	0.3	0.1	0.0
90			

Moon's Lower Limb **Add**

Alt.	16	17	18
°	′	′	′
0	17.6	16.4	15.3
4	17.6	16.4	15.3
8	17.6	16.4	15.3
12	17.5	16.4	15.3
16	17.5	16.4	15.3
20	17.5	16.4	15.3
24	17.4	16.4	15.3
28	17.4	16.3	15.3
32	17.3	16.3	15.3
36	17.2	16.3	15.3
40	17.2	16.3	15.3
44	17.1	16.2	15.4
48	17.0	16.2	15.4
52	16.9	16.2	15.4
56	16.8	16.1	15.4
60	16.7	16.1	15.4
64	16.6	16.0	15.4
68	16.5	16.0	15.4
72	16.4	15.9	15.4
76	16.3	15.9	15.5
80	16.2	15.8	15.5
84	16.1	15.8	15.5
88	16.0	15.8	15.5
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	16	17	18
°	′	′	′
0	14.4	15.0	15.7
4	14.4	15.0	15.7
8	14.4	15.1	15.7
12	14.4	15.1	15.7
16	14.5	15.1	15.7
20	14.5	15.1	15.7
24	14.5	15.1	15.7
28	14.6	15.1	15.7
32	14.7	15.2	15.7
36	14.7	15.2	15.7
40	14.8	15.2	15.6
44	14.9	15.3	15.6
48	15.0	15.3	15.6
52	15.0	15.3	15.6
56	15.1	15.4	15.6
60	15.2	15.4	15.6
64	15.3	15.5	15.6
68	15.4	15.5	15.6
72	15.5	15.5	15.6
76	15.7	15.6	15.5
80	15.8	15.6	15.5
84	15.9	15.7	15.5
88	16.0	15.7	15.5
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.3 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
19 0	206 47.9	190 55.8	+13 09.9	157 56.4	+18 26.7	153 41.3	+18 24.0	3 55.4	− 6 35.3	110 45.5	81	+26 06.1	− 38
1	221 50.4	205 59.4	08.9	172 57.1	27.1	168 43.2	24.2	18 58.0	35.2	125 12.6	81	26 02.3	− 39
2	236 52.8	221 03.0	07.9	187 57.8	27.6	183 45.1	24.3	34 00.6	35.1	139 39.7	83	25 58.4	− 40
3	251 55.3	236 06.6	•• 06.9	202 58.4	•• 28.1	198 47.0	•• 24.4	49 03.3	•• 35.0	154 07.0	84	•25 54.4	− 42
4	266 57.7	251 10.1	05.9	217 59.1	28.6	213 48.9	24.6	64 05.9	35.0	168 34.4	84	25 50.2	− 43
5	282 00.2	266 13.7	04.8	232 59.8	29.1	228 50.8	24.7	79 08.6	34.9	183 01.8	85	25 45.9	− 45
6	297 02.7	281 17.3	+13 03.8	248 00.4	+18 29.6	243 52.7	+18 24.9	94 11.2	− 6 34.8	197 29.3	86	+25 41.4	− 46
7	312 05.1	296 20.9	02.8	263 01.1	30.1	258 54.6	25.0	109 13.9	34.8	211 56.9	87	25 36.8	− 47
8	327 07.6	311 24.4	01.8	278 01.8	30.5	273 56.5	25.1	124 16.5	34.7	226 24.6	88	25 32.1	− 48
9	342 10.1	326 28.0	•13 00.8	293 02.4	•• 31.0	288 58.4	•• 25.3	139 19.2	•• 34.6	240 52.4	89	•25 27.3	− 50
10	357 12.5	341 31.6	12 59.8	308 03.1	31.5	304 00.3	25.4	154 21.8	34.6	255 20.3	89	25 22.3	− 51
11	12 15.0	356 35.1	58.8	323 03.8	32.0	319 02.2	25.6	169 24.4	34.5	269 48.2	91	25 17.2	− 52
12	27 17.5	11 38.7	+12 57.8	338 04.5	+18 32.5	334 04.1	+18 25.7	184 27.1	− 6 34.4	284 16.3	91	+25 12.0	− 53
13	42 19.9	26 42.2	56.7	353 05.1	33.0	349 06.0	25.8	199 29.7	34.4	298 44.4	93	25 06.7	− 55
14	57 22.4	41 45.8	55.7	8 05.8	33.5	4 07.9	26.0	214 32.4	34.3	313 12.7	93	25 01.2	− 56
15	72 24.9	56 49.3	•• 54.7	23 06.5	•• 33.9	19 09.7	•• 26.1	229 35.0	•• 34.2	327 41.0	94	•24 55.6	− 57
16	87 27.3	71 52.9	53.7	38 07.1	34.4	34 11.6	26.2	244 37.7	34.1	342 09.4	95	24 49.9	− 59
17	102 29.8	86 56.4	52.7	53 07.8	34.9	49 13.5	26.4	259 40.3	34.1	356 37.9	96	24 44.0	− 60
18	117 32.2	102 00.0	+12 51.7	68 08.5	+18 35.4	64 15.4	+18 26.5	274 42.9	− 6 34.0	11 06.5	97	+24 38.0	− 60
19	132 34.7	117 03.5	50.7	83 09.1	35.9	79 17.3	26.7	289 45.6	33.9	25 35.2	98	24 32.0	− 62
20	147 37.2	132 07.0	49.7	98 09.8	36.3	94 19.2	26.8	304 48.2	33.9	40 04.0	99	24 25.8	− 64
21	162 39.6	147 10.6	•• 48.6	113 10.5	•• 36.8	109 21.1	•• 26.9	319 50.9	•• 33.8	54 32.9	99	•24 19.4	− 64
22	177 42.1	162 14.1	47.6	128 11.1	37.3	124 23.0	27.1	334 53.5	33.7	69 01.8	101	24 13.0	− 65
23	192 44.6	177 17.6	46.6	143 11.8	37.8	139 24.9	27.2	349 56.2	33.7	83 30.9	102	24 06.5	− 67
20 0	207 47.0	192 21.2	+12 45.6	158 12.5	+18 38.3	154 26.8	+18 27.4	4 58.8	− 6 33.6	98 00.1	102	+23 59.8	− 68
1	222 49.5	207 24.7	44.6	173 13.1	38.7	169 28.7	27.5	20 01.4	33.5	112 29.3	104	23 53.0	− 69
2	237 52.0	222 28.2	43.6	188 13.8	39.2	184 30.6	27.6	35 04.1	33.5	126 58.7	104	23 46.1	− 70
3	252 54.4	237 31.7	•• 42.6	203 14.5	•• 39.7	199 32.5	•• 27.8	50 06.7	•• 33.4	141 28.1	105	•23 39.1	− 71
4	267 56.9	252 35.2	41.6	218 15.1	40.2	214 34.3	27.9	65 09.4	33.3	155 57.6	106	23 32.0	− 72
5	282 59.3	267 38.7	40.6	233 15.8	40.7	229 36.2	28.0	80 12.0	33.3	170 27.2	108	23 24.8	− 73
6	298 01.8	282 42.2	+12 39.6	248 16.5	+18 41.1	244 38.1	+18 28.2	95 14.7	− 6 33.2	184 57.0	108	+23 17.5	− 74
7	313 04.3	297 45.7	38.6	263 17.1	41.6	259 40.0	28.3	110 17.3	33.1	199 26.8	109	23 10.1	− 76
8	328 06.7	312 49.2	37.6	278 17.8	42.1	274 41.9	28.5	125 19.9	33.0	213 56.7	110	23 02.5	− 76
9	343 09.2	327 52.7	•• 36.5	293 18.5	•• 42.6	289 43.8	•• 28.6	140 22.6	•• 33.0	228 26.7	111	•22 54.9	− 78
10	358 11.7	342 56.2	35.5	308 19.1	43.1	304 45.7	28.7	155 25.2	32.9	242 56.8	112	22 47.1	− 78
11	13 14.1	357 59.7	34.5	323 19.8	43.5	319 47.6	28.9	170 27.9	32.8	257 27.0	112	22 39.3	− 79
12	28 16.6	13 03.2	+12 33.5	338 20.5	+18 44.0	334 49.5	+18 29.0	185 30.5	− 6 32.8	271 57.2	114	+22 31.4	− 81
13	43 19.1	28 06.7	32.5	353 21.1	44.5	349 51.4	29.1	200 33.2	32.7	286 27.6	115	22 23.3	− 81
14	58 21.5	43 10.2	31.5	8 21.8	45.0	4 53.3	29.3	215 35.8	32.6	300 58.1	115	22 15.2	− 82
15	73 24.0	58 13.7	•• 30.5	23 22.5	•• 45.4	19 55.2	•• 29.4	230 38.4	•• 32.6	315 28.6	117	•22 07.0	− 84
16	88 26.5	73 17.1	29.5	38 23.1	45.9	34 57.0	29.6	245 41.1	32.5	329 59.3	117	21 58.6	− 84
17	103 28.9	88 20.6	28.5	53 23.8	46.4	49 58.9	29.7	260 43.7	32.4	344 30.0	118	21 50.2	− 85
18	118 31.4	103 24.1	+12 27.5	68 24.5	+18 46.9	65 00.8	+18 29.8	275 46.4	− 6 32.4	359 00.8	120	+21 41.7	− 86
19	133 33.8	118 27.6	26.5	83 25.1	47.3	80 02.7	30.0	290 49.0	32.3	13 31.8	120	21 33.1	− 87
20	148 36.3	133 31.0	25.5	98 25.8	47.8	95 04.6	30.1	305 51.7	32.2	28 02.8	121	21 24.4	− 88
21	163 38.8	148 34.5	•• 24.5	113 26.5	•• 48.3	110 06.5	•• 30.3	320 54.3	•• 32.2	42 33.9	122	•21 15.6	− 89
22	178 41.2	163 38.0	23.5	128 27.1	48.8	125 08.4	30.4	335 56.9	32.1	57 05.1	122	21 06.7	− 89
23	193 43.7	178 41.4	22.5	143 27.8	49.2	140 10.3	30.5	350 59.6	32.0	71 36.3	124	20 57.8	− 91
21 0	208 46.2	193 44.9	+12 21.5	158 28.5	+18 49.7	155 12.2	+18 30.7	6 02.2	− 6 32.0	86 07.7	124	+20 48.7	− 91
1	223 48.6	208 48.3	20.5	173 29.1	50.2	170 14.1	30.8	21 04.9	31.9	100 39.1	126	20 39.6	− 92
2	238 51.1	223 51.8	19.5	188 29.8	50.7	185 16.0	30.9	36 07.5	31.8	115 10.7	126	20 30.4	− 93
3	253 53.6	238 55.2	•• 18.5	203 30.5	•• 51.1	200 17.8	•• 31.1	51 10.1	•• 31.7	129 42.3	127	•20 21.1	− 94
4	268 56.0	253 58.6	17.5	218 31.1	51.6	215 19.7	31.2	66 12.8	31.7	144 14.0	128	20 11.7	− 95
5	283 58.5	269 02.1	16.5	233 31.8	52.1	230 21.6	31.4	81 15.4	31.6	158 45.8	129	20 02.2	− 95
6	299 01.0	284 05.5	+12 15.5	248 32.5	+18 52.5	245 23.5	+18 31.5	96 18.1	− 6 31.5	173 17.7	130	+19 52.7	− 97
7	314 03.4	299 08.9	14.5	263 33.1	53.0	260 25.4	31.6	111 20.7	31.5	187 49.7	130	19 43.0	− 97
8	329 05.9	314 12.4	13.5	278 33.8	53.5	275 27.3	31.8	126 23.4	31.4	202 21.7	132	19 33.3	− 98
9	344 08.3	329 15.8	•• 12.5	293 34.5	•• 53.9	290 29.2	•• 31.9	141 26.0	•• 31.3	216 53.9	132	•19 23.5	− 98
10	359 10.8	344 19.2	11.5	308 35.1	54.4	305 31.1	32.0	156 28.6	31.3	231 26.1	133	19 13.7	−100
11	14 13.3	359 22.6	10.5	323 35.8	54.9	320 33.0	32.2	171 31.3	31.2	245 58.4	134	19 03.7	−100
12	29 15.7	14 26.1	+12 09.5	338 36.5	+18 55.4	335 34.8	+18 32.3	186 33.9	− 6 31.1	260 30.8	134	+18 53.7	−101
13	44 18.2	29 29.5	08.5	353 37.1	55.8	350 36.7	32.5	201 36.6	31.1	275 03.2	136	18 43.6	−101
14	59 20.7	44 32.9	07.6	8 37.8	56.3	5 38.6	32.6	216 39.2	31.0	289 35.8	136	18 33.5	−103
15	74 23.1	59 36.3	•• 06.6	23 38.5	•• 56.8	20 40.5	•• 32.7	231 41.9	•• 30.9	304 08.4	137	•18 23.2	−103
16	89 25.6	74 39.7	05.6	38 39.1	57.2	35 42.4	32.9	246 44.5	30.9	318 41.1	138	18 12.9	−103
17	104 28.1	89 43.1	04.6	53 39.8	57.7	50 44.3	33.0	261 47.1	30.8	333 13.9	138	18 02.6	−105
18	119 30.5	104 46.5	+12 03.6	68 40.4	+18 58.2	65 46.2	+18 33.1	276 49.8	− 6 30.7	347 46.7	140	+17 52.1	−105
19	134 33.0	119 49.9	02.6	83 41.1	58.6	80 48.1	33.3	291 52.4	30.7	2 19.7	140	17 41.6	−105
20	149 35.5	134 53.3	01.6	98 41.8	59.1	95 50.0	33.4	306 55.1	30.6	16 52.7	141	17 31.1	−107
21	164 37.9	149 56.6	•12 00.6	113 42.4	•18 59.6	110 51.8	•• 33.6	321 57.7	•• 30.5	31 25.8	141	•17 20.4	−107
22	179 40.4	165 00.0	11 59.6	128 43.1	19 00.0	125 53.7	33.7	337 00.3	30.5	45 58.9	142	17 09.7	−108
23	194 42.8	180 03.4	58.6	143 43.8	00.5	140 55.6	33.8	352 03.0	30.4	60 32.1	143	16 58.9	−108
24	209 45.3	195 06.8	+11 57.7	158 44.4	+19 01.0	155 57.5	+18 34.0	7 05.6	− 6 30.3	75 05.4	144	+16 48.1	−109
code	—	+ 35	− 10	+ 6	+ 5	+ 19	+ 1	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
19 h	° ′	° ′
0	180 11.2	+10 59.7
1	195 11.4	11 00.5
2	210 11.5	01.4
3	225 11.7	02.3
4	240 11.8	03.1
5	255 11.9	04.0
6	270 12.1	+11 04.9
7	285 12.2	05.7
8	300 12.3	06.6
9	315 12.5	07.5
10	330 12.6	08.3
11	345 12.8	09.2
12	0 12.9	+11 10.1
13	15 13.0	10.9
14	30 13.2	11.8
15	45 13.3	12.7
16	60 13.4	13.5
17	75 13.6	14.4
18	90 13.7	+11 15.3
19	105 13.8	16.1
20	120 14.0	17.0
21	135 14.1	17.8
22	150 14.3	18.7
23	165 14.4	19.6
20 0	180 14.5	+11 20.4
1	195 14.7	21.3
2	210 14.8	22.2
3	225 14.9	23.0
4	240 15.1	23.9
5	255 15.2	24.7
6	270 15.3	+11 25.6
7	285 15.5	26.4
8	300 15.6	27.3
9	315 15.7	28.2
10	330 15.9	29.0
11	345 16.0	29.9
12	0 16.1	+11 30.7
13	15 16.3	31.6
14	30 16.4	32.5
15	45 16.5	33.3
16	60 16.7	34.2
17	75 16.8	35.0
18	90 16.9	+11 35.9
19	105 17.1	36.7
20	120 17.2	37.6
21	135 17.3	38.4
22	150 17.4	39.3
23	165 17.6	40.1
21 0	180 17.7	+11 41.0
1	195 17.8	41.9
2	210 18.0	42.7
3	225 18.1	43.6
4	240 18.2	44.4
5	255 18.4	45.3
6	270 18.5	+11 46.1
7	285 18.6	47.0
8	300 18.7	47.8
9	315 18.9	48.7
10	330 19.0	49.5
11	345 19.1	50.4
12	0 19.3	+11 51.2
13	15 19.4	52.1
14	30 19.5	52.9
15	45 19.6	53.8
16	60 19.8	54.6
17	75 19.9	55.4
18	90 20.0	+11 56.3
19	105 20.2	57.1
20	120 20.3	58.0
21	135 20.4	58.8
22	150 20.5	11 59.7
23	165 20.7	12 00.5
24	180 20.8	+12 01.4
code	—	+ 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.5
5	Achernar	336 00.6	−57 28.3
30	Acrux	173 59.5	−62 50.7
19	Adhara	255 48.1	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.4	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.3	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.7	+28 49.9
51	Altair	62 52.2	+ 8 44.4
2	Ankaa	354 00.4	−42 33.5
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.5	−68 56.7
22	Avior	234 36.6	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.0
17	Canopus	264 16.5	−52 40.4
12	Capella	281 41.5	+45 57.4
53	Deneb	50 02.4	+45 06.4
28	Denebola	183 19.3	+14 49.9
4	Diphda	349 41.4	−18 14.5
27	Dubhe	194 46.2	+62 00.3
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.8	+51 29.2
54	Enif	34 31.6	+ 9 39.5
56	Fomalhaut	16 13.9	−29 52.1
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.6	−60 09.1
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.5	−34 24.6
40	Kochab	137 16.3	+74 20.6
57	Markab	14 23.6	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.7
24	Miapl'dus	221 49.5	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.1	−26 21.4
52	Peacock	54 30.2	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.1	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.9
44	Sabik	103 04.1	−15 40.3
3	Schedar	350 32.8	+56 16.8
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 13.6	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.7	−43 14.9
49	Vega	81 09.4	+38 44.0
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 19	20	21
h	m s	m s	m s
0	+ 0 44.7	+ 0 57.8	+ 1 10.6
6	+ 0 48.0	+ 1 01.0	+ 1 13.7
12	+ 0 51.3	+ 1 04.2	+ 1 16.8
18	+ 0 54.6	+ 1 07.4	+ 1 19.8
24	+ 0 57.8	+ 1 10.6	+ 1 22.9

Lat.	Sunrise	Twlt. begins	Moonrise 19	20	21	22
N °	h m	h m	h m	h m	h m	h m
72	3 11	////	▭	▭	▭	9 36
70	3 32	////	▭	▭	7 19	10 11
68	3 48	////	▭	▭	8 29	10 36
66	4 01	////	▭	6 49	9 05	10 55
64	4 12	////	5 31	7 42	9 31	11 10
62	4 22	////	6 36	8 14	9 51	11 22
60	4 30	0 49	7 10	8 38	10 07	11 33
58	4 37	1 35	7 35	8 57	10 21	11 42
56	4 43	2 03	7 55	9 13	10 32	11 50
54	4 48	2 24	8 12	9 26	10 43	11 57
52	4 53	2 39	8 26	9 38	10 51	12 04
50	4 58	2 53	8 38	9 48	11 00	12 10
45	5 07	3 19	9 04	10 10	11 17	12 22
40	5 15	3 38	9 24	10 27	11 31	12 32
35	5 22	3 53	9 41	10 42	11 42	12 41
30	5 28	4 05	9 55	10 55	11 53	12 48
20	5 38	4 23	10 20	11 16	12 10	13 01
10	5 47	4 36	10 42	11 35	12 25	13 13
0	5 56	4 46	11 01	11 52	12 40	13 23
10	6 04	4 53	11 21	12 10	12 54	13 34
20	6 12	4 58	11 42	12 28	13 09	13 45
30	6 22	5 01	12 07	12 50	13 26	13 58
35	6 27	5 02	12 21	13 02	13 36	14 05
40	6 34	5 02	12 38	13 16	13 47	14 14
45	6 41	5 01	12 58	13 33	14 01	14 24
50	6 49	5 00	13 22	13 54	14 17	14 35
52	6 53	4 59	13 34	14 04	14 24	14 41
54	6 58	4 58	13 48	14 14	14 33	14 47
56	7 02	4 56	14 04	14 27	14 42	14 53
58	7 08	4 54	14 22	14 41	14 53	15 00
60	7 14	4 51	14 45	14 58	15 05	15 09
S						

Lat.	Sunset	Twlt. ends	Moonset 19	20	21	22
N °	h m	h m	h m	h m	h m	h m
72	20 51	////	▭	▭	▭	5 10
70	20 29	////	▭	▭	5 53	4 33
68	20 13	////	▭	▭	4 41	4 07
66	19 59	////	▭	4 41	4 04	3 47
64	19 48	////	4 09	3 47	3 38	3 31
62	19 38	////	3 05	3 14	3 17	3 17
60	19 30	23 29	2 30	2 50	3 00	3 05
58	19 23	22 31	2 05	2 31	2 46	2 55
56	19 17	22 02	1 45	2 14	2 34	2 47
54	19 11	21 40	1 28	2 00	2 23	2 39
52	19 06	21 23	1 13	1 48	2 13	2 32
50	19 01	21 09	1 01	1 37	2 05	2 25
45	18 51	20 42	0 35	1 15	1 46	2 11
40	18 43	20 22	0 14	0 57	1 31	2 00
35	18 36	20 07	24 41	0 41	1 19	1 50
30	18 30	19 54	24 28	0 28	1 07	1 42
20	18 20	19 36	24 05	0 05	0 48	1 27
10	18 11	19 23	23 45	24 31	0 31	1 13
0	18 02	19 12	23 26	24 16	0 16	1 01
10	17 54	19 05	23 08	24 00	0 00	0 49
20	17 45	18 59	22 48	23 43	24 35	0 35
30	17 36	18 56	22 24	23 23	24 20	0 20
35	17 30	18 55	22 10	23 11	24 11	0 11
40	17 24	18 55	21 54	22 58	24 00	0 00
45	17 16	18 54	21 35	22 42	23 48	24 53
50	17 08	18 56	21 11	22 22	23 33	24 43
52	17 04	18 57	20 59	22 13	23 26	24 38
54	16 59	18 57	20 46	22 02	23 19	24 33
56	16 54	18 59	20 31	21 50	23 10	24 27
58	16 49	19 01	20 13	21 37	23 00	24 20
60	16 43	19 03	19 50	21 20	22 49	24 13
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
19	17 14	11 14	13 28	13 44	23 40
20	18 04	11 08	13 27	13 41	23 36
21	18 50	11 03	13 26	13 38	23 32
22	19 34	10 57	13 24	13 35	23 28

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.5	0.1
30	0.2	0.4	0.0
45	0.2	0.3	0.0
60	0.2	0.2	0.0
75	0.2	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	19	20	21
°	′	′	′
0	14.3	13.4	12.8
4	14.3	13.4	12.8
8	14.3	13.4	12.8
12	14.3	13.4	12.8
16	14.3	13.5	12.9
20	14.4	13.5	12.9
24	14.4	13.6	13.0
28	14.4	13.6	13.0
32	14.4	13.7	13.1
36	14.5	13.7	13.2
40	14.5	13.8	13.3
44	14.6	13.9	13.4
48	14.6	14.0	13.5
52	14.7	14.1	13.7
56	14.7	14.2	13.8
60	14.8	14.3	13.9
64	14.9	14.4	14.1
68	14.9	14.5	14.2
72	15.0	14.6	14.3
76	15.1	14.7	14.5
80	15.1	14.9	14.6
84	15.2	15.0	14.8
88	15.3	15.1	14.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	19	20	21
°	′	′	′
0	16.3	16.8	17.2
4	16.3	16.8	17.1
8	16.3	16.8	17.1
12	16.2	16.7	17.1
16	16.2	16.7	17.0
20	16.2	16.7	17.0
24	16.2	16.6	16.9
28	16.1	16.6	16.9
32	16.1	16.5	16.8
36	16.1	16.4	16.7
40	16.0	16.4	16.6
44	16.0	16.3	16.5
48	15.9	16.2	16.4
52	15.9	16.1	16.2
56	15.8	16.0	16.1
60	15.7	15.9	16.0
64	15.7	15.8	15.8
68	15.6	15.7	15.7
72	15.6	15.6	15.6
76	15.5	15.4	15.4
80	15.4	15.3	15.3
84	15.3	15.2	15.1
88	15.3	15.1	15.0
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
22 0	209 45.3	195 06.8	+11 57.7	158 44.4	+19 01.0	155 57.5	+18 34.0	7 05.6	− 6 30.3	75 05.4	144	+16 48.1	−109
1	224 47.8	210 10.2	56.7	173 45.1	01.4	170 59.4	34.1	22 08.3	30.2	89 38.8	145	16 37.2	−109
2	239 50.2	225 13.5	55.7	188 45.8	01.9	186 01.3	34.2	37 10.9	30.2	104 12.3	145	16 26.3	−110
3	254 52.7	240 16.9	•• 54.7	203 46.4	•• 02.4	201 03.2	•• 34.4	52 13.6	•• 30.1	118 45.8	145	•16 15.3	−111
4	269 55.2	255 20.3	53.7	218 47.1	02.8	216 05.1	34.5	67 16.2	30.0	133 19.3	147	16 04.2	−112
5	284 57.6	270 23.6	52.7	233 47.8	03.3	231 06.9	34.7	82 18.8	30.0	147 53.0	147	15 53.0	−112
6	300 00.1	285 27.0	+11 51.8	248 48.4	+19 03.7	246 08.8	+18 34.8	97 21.5	− 6 29.9	162 26.7	148	+15 41.8	−112
7	315 02.6	300 30.3	50.8	263 49.1	04.2	261 10.7	34.9	112 24.1	29.8	177 00.5	148	15 30.6	−113
8	330 05.0	315 33.7	49.8	278 49.7	04.7	276 12.6	35.1	127 26.8	29.8	191 34.3	149	15 19.3	−114
9	345 07.5	330 37.0	•• 48.8	293 50.4	•• 05.1	291 14.5	•• 35.2	142 29.4	•• 29.7	206 08.2	150	•15 07.9	−114
10	0 09.9	345 40.4	47.9	308 51.1	05.6	306 16.4	35.3	157 32.0	29.6	220 42.2	151	14 56.5	−115
11	15 12.4	0 43.7	46.9	323 51.7	06.1	321 18.3	35.5	172 34.7	29.6	235 16.3	151	14 45.0	−115
12	30 14.9	15 47.0	+11 45.9	338 52.4	+19 06.5	336 20.2	+18 35.6	187 37.3	− 6 29.5	249 50.4	151	+14 33.5	−116
13	45 17.3	30 50.4	44.9	353 53.1	07.0	351 22.0	35.8	202 40.0	29.4	264 24.5	152	14 21.9	−116
14	60 19.8	45 53.7	44.0	8 53.7	07.4	6 23.9	35.9	217 42.6	29.4	278 58.7	153	14 10.3	−117
15	75 22.3	60 57.0	•• 43.0	23 54.4	•• 07.9	21 25.8	•• 36.0	232 45.3	•• 29.3	293 33.0	153	•13 58.6	−117
16	90 24.7	76 00.3	42.0	38 55.0	08.4	36 27.7	36.2	247 47.9	29.2	308 07.3	154	13 46.9	−118
17	105 27.2	91 03.7	41.0	53 55.7	08.8	51 29.6	36.3	262 50.5	29.2	322 41.7	155	13 35.1	−118
18	120 29.7	106 07.0	+11 40.1	68 56.4	+19 09.3	66 31.5	+18 36.4	277 53.2	− 6 29.1	337 16.2	155	+13 23.3	−118
19	135 32.1	121 10.3	39.1	83 57.0	09.7	81 33.4	36.6	292 55.8	29.0	351 50.7	155	13 11.5	−120
20	150 34.6	136 13.6	38.1	98 57.7	10.2	96 35.3	36.7	307 58.5	29.0	6 25.2	157	12 59.5	−119
21	165 37.1	151 16.9	•• 37.2	113 58.4	•• 10.7	111 37.1	•• 36.9	323 01.1	•• 28.9	20 59.9	156	•12 47.6	−120
22	180 39.5	166 20.2	36.2	128 59.0	11.1	126 39.0	37.0	338 03.7	28.8	35 34.5	157	12 35.6	−121
23	195 42.0	181 23.5	35.2	143 59.7	11.6	141 40.9	37.1	353 06.4	28.8	50 09.2	158	12 23.5	−121
23 0	210 44.4	196 26.8	+11 34.3	159 00.3	+19 12.0	156 42.8	+18 37.3	8 09.0	− 6 28.7	64 44.0	158	+12 11.4	−121
1	225 46.9	211 30.1	33.3	174 01.0	12.5	171 44.7	37.4	23 11.7	28.6	79 18.8	159	11 59.3	−122
2	240 49.4	226 33.4	32.3	189 01.7	13.0	186 46.6	37.5	38 14.3	28.6	93 53.7	159	11 47.1	−122
3	255 51.8	241 36.7	•• 31.4	204 02.3	•• 13.4	201 48.5	•• 37.7	53 16.9	•• 28.5	108 28.6	159	•11 34.9	−123
4	270 54.3	256 40.0	30.4	219 03.0	13.9	216 50.3	37.8	68 19.6	28.4	123 03.5	160	11 22.6	−123
5	285 56.8	271 43.2	29.4	234 03.6	14.3	231 52.2	37.9	83 22.2	28.4	137 38.5	161	11 10.3	−123
6	300 59.2	286 46.5	+11 28.5	249 04.3	+19 14.8	246 54.1	+18 38.1	98 24.9	− 6 28.3	152 13.6	161	+10 58.0	−124
7	316 01.7	301 49.8	27.5	264 05.0	15.2	261 56.0	38.2	113 27.5	28.2	166 48.7	161	10 45.6	−124
8	331 04.2	316 53.0	26.6	279 05.6	15.7	276 57.9	38.4	128 30.2	28.2	181 23.8	162	10 33.2	−125
9	346 06.6	331 56.3	•• 25.6	294 06.3	•• 16.1	291 59.8	•• 38.5	143 32.8	•• 28.1	195 59.0	162	•10 20.7	−125
10	1 09.1	346 59.6	24.7	309 07.0	16.6	307 01.7	38.6	158 35.4	28.0	210 34.2	162	10 08.2	−125
11	16 11.6	2 02.8	23.7	324 07.6	17.1	322 03.5	38.8	173 38.1	28.0	225 09.4	163	9 55.7	−125
12	31 14.0	17 06.1	+11 22.8	339 08.3	+19 17.5	337 05.4	+18 38.9	188 40.7	− 6 27.9	239 44.7	164	+ 9 43.2	−126
13	46 16.5	32 09.3	21.8	354 08.9	18.0	352 07.3	39.0	203 43.4	27.8	254 20.1	163	9 30.6	−127
14	61 18.9	47 12.6	20.8	9 09.6	18.4	7 09.2	39.2	218 46.0	27.8	268 55.4	164	9 17.9	−126
15	76 21.4	62 15.8	•• 19.9	24 10.3	•• 18.9	22 11.1	•• 39.3	233 48.6	•• 27.7	283 30.8	165	• 9 05.3	−127
16	91 23.9	77 19.1	18.9	39 10.9	19.3	37 13.0	39.5	248 51.3	27.6	298 06.3	164	8 52.6	−127
17	106 26.3	92 22.3	18.0	54 11.6	19.8	52 14.9	39.6	263 53.9	27.6	312 41.7	165	8 39.9	−128
18	121 28.8	107 25.5	+11 17.0	69 12.2	+19 20.2	67 16.7	+18 39.7	278 56.6	− 6 27.5	327 17.2	166	+ 8 27.1	−128
19	136 31.3	122 28.8	16.1	84 12.9	20.7	82 18.6	39.9	293 59.2	27.4	341 52.8	165	8 14.3	−128
20	151 33.7	137 32.0	15.2	99 13.6	21.1	97 20.5	40.0	309 01.8	27.4	356 28.3	166	8 01.5	−128
21	166 36.2	152 35.2	•• 14.2	114 14.2	•• 21.6	112 22.4	•• 40.1	324 04.5	•• 27.3	11 03.9	166	• 7 48.7	−129
22	181 38.7	167 38.4	13.3	129 14.9	22.0	127 24.3	40.3	339 07.1	27.2	25 39.5	167	7 35.8	−129
23	196 41.1	182 41.6	12.3	144 15.5	22.5	142 26.2	40.4	354 09.8	27.1	40 15.2	167	7 22.9	−129
24 0	211 43.6	197 44.9	+11 11.4	159 16.2	+19 22.9	157 28.0	+18 40.5	9 12.4	− 6 27.1	54 50.9	166	+ 7 10.0	−129
1	226 46.0	212 48.1	10.4	174 16.9	23.4	172 29.9	40.7	24 15.0	27.0	69 26.5	168	6 57.1	−130
2	241 48.5	227 51.3	09.5	189 17.5	23.8	187 31.8	40.8	39 17.7	26.9	84 02.3	167	6 44.1	−130
3	256 51.0	242 54.5	•• 08.6	204 18.2	•• 24.3	202 33.7	•• 41.0	54 20.3	•• 26.9	98 38.0	168	• 6 31.1	−130
4	271 53.4	257 57.7	07.6	219 18.8	24.7	217 35.6	41.1	69 23.0	26.8	113 13.8	168	6 18.1	−131
5	286 55.9	273 00.8	06.7	234 19.5	25.2	232 37.5	41.2	84 25.6	26.7	127 49.6	168	6 05.0	−130
6	301 58.4	288 04.0	+11 05.8	249 20.2	+19 25.6	247 39.4	+18 41.4	99 28.2	− 6 26.7	142 25.4	168	+ 5 52.0	−131
7	317 00.8	303 07.2	04.8	264 20.8	26.1	262 41.2	41.5	114 30.9	26.6	157 01.2	168	5 38.9	−131
8	332 03.3	318 10.4	03.9	279 21.5	26.5	277 43.1	41.6	129 33.5	26.6	171 37.0	169	5 25.8	−131
9	347 05.8	333 13.6	•• 03.0	294 22.1	•• 27.0	292 45.0	•• 41.8	144 36.2	•• 26.5	186 12.9	169	• 5 12.7	−132
10	2 08.2	348 16.8	02.0	309 22.8	27.4	307 46.9	41.9	159 38.8	26.4	200 48.8	169	4 59.5	−131
11	17 10.7	3 19.9	01.1	324 23.5	27.9	322 48.8	42.0	174 41.4	26.4	215 24.7	169	4 46.4	−132
12	32 13.2	18 23.1	+11 00.2	339 24.1	+19 28.3	337 50.7	+18 42.2	189 44.1	− 6 26.3	230 00.6	169	+ 4 33.2	−132
13	47 15.6	33 26.3	10 59.3	354 24.8	28.8	352 52.5	42.3	204 46.7	26.2	244 36.5	169	4 20.0	−132
14	62 18.1	48 29.4	58.3	9 25.4	29.2	7 54.4	42.5	219 49.4	26.2	259 12.4	170	4 06.8	−133
15	77 20.5	63 32.6	•• 57.4	24 26.1	•• 29.7	22 56.3	•• 42.6	234 52.0	•• 26.1	273 48.4	169	• 3 53.5	−132
16	92 23.0	78 35.7	56.5	39 26.7	30.1	37 58.2	42.7	249 54.6	26.0	288 24.3	170	3 40.3	−133
17	107 25.5	93 38.9	55.6	54 27.4	30.5	53 00.1	42.9	264 57.3	26.0	303 00.3	170	3 27.0	−133
18	122 27.9	108 42.0	+10 54.6	69 28.1	+19 31.0	68 01.9	+18 43.0	279 59.9	− 6 25.9	317 36.3	169	+ 3 13.7	−133
19	137 30.4	123 45.2	53.7	84 28.7	31.4	83 03.8	43.1	295 02.6	25.8	332 12.2	170	3 00.4	−133
20	152 32.9	138 48.3	52.8	99 29.4	31.9	98 05.7	43.3	310 05.2	25.8	346 48.2	170	2 47.1	−133
21	167 35.3	153 51.4	•• 51.9	114 30.0	•• 32.3	113 07.6	•• 43.4	325 07.8	•• 25.7	1 24.2	170	• 2 33.8	−133
22	182 37.8	168 54.6	51.0	129 30.7	32.8	128 09.5	43.5	340 10.5	25.6	16 00.2	170	2 20.5	−133
23	197 40.3	183 57.7	50.1	144 31.4	33.2	143 11.4	43.7	355 13.1	25.6	30 36.2	170	2 07.2	−134
24	212 42.7	199 00.8	+10 49.1	159 32.0	+19 33.7	158 13.2	+18 43.8	10 15.8	− 6 25.5	45 12.2	170	+ 1 53.8	−134
code	−	+ 32	− 10	+ 6	+ 5	+ 19	+ 1	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
22 0	180 20.8	+12 01.4
1	195 20.9	02.2
2	210 21.0	03.1
3	225 21.2	·· 03.9
4	240 21.3	04.7
5	255 21.4	05.6
6	270 21.5	+12 06.4
7	285 21.7	07.3
8	300 21.8	08.1
9	315 21.9	·· 09.0
10	330 22.0	09.8
11	345 22.2	10.6
12	0 22.3	+12 11.5
13	15 22.4	12.3
14	30 22.5	13.2
15	45 22.7	·· 14.0
16	60 22.8	14.8
17	75 22.9	15.7
18	90 23.0	+12 16.5
19	105 23.1	17.4
20	120 23.3	18.2
21	135 23.4	·· 19.0
22	150 23.5	19.9
23	165 23.6	20.7
23 0	180 23.8	+12 21.5
1	195 23.9	22.4
2	210 24.0	23.2
3	225 24.1	·· 24.1
4	240 24.2	24.9
5	255 24.4	25.7
6	270 24.5	+12 26.6
7	285 24.6	27.4
8	300 24.7	28.2
9	315 24.8	·· 29.1
10	330 25.0	29.9
11	345 25.1	30.7
12	0 25.2	+12 31.6
13	15 25.3	32.4
14	30 25.4	33.2
15	45 25.6	·· 34.1
16	60 25.7	34.9
17	75 25.8	35.7
18	90 25.9	+12 36.5
19	105 26.0	37.4
20	120 26.2	38.2
21	135 26.3	·· 39.0
22	150 26.4	39.9
23	165 26.5	40.7
24 0	180 26.6	+12 41.5
1	195 26.7	42.3
2	210 26.9	43.2
3	225 27.0	·· 44.0
4	240 27.1	44.8
5	255 27.2	45.7
6	270 27.3	+12 46.5
7	285 27.4	47.3
8	300 27.6	48.1
9	315 27.7	·· 49.0
10	330 27.8	49.8
11	345 27.9	50.6
12	0 28.0	+12 51.4
13	15 28.1	52.3
14	30 28.2	53.1
15	45 28.4	·· 53.9
16	60 28.5	54.7
17	75 28.6	55.5
18	90 28.7	+12 56.4
19	105 28.8	57.2
20	120 28.9	58.0
21	135 29.0	·· 58.8
22	150 29.2	12 59.6
23	165 29.3	13 00.5
24	180 29.4	+13 01.3
code	—	+ 8

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.3
30	Acrux	173 59.5	−62 50.7
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.4	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.6	+28 49.9
51	Altair	62 52.2	+ 8 44.4
2	Ankaa	354 00.4	−42 33.4
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.4	−68 56.7
22	Avior	234 36.7	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.5	−52 40.4
12	Capella	281 41.6	+45 57.4
53	Deneb	50 02.4	+45 06.4
28	Denebola	183 19.3	+14 49.9
4	Diphda	349 41.4	−18 14.5
27	Dubhe	194 46.2	+62 00.3
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.8	+51 29.3
54	Enif	34 31.6	+ 9 39.5
56	Fomalhaut	16 13.8	−29 52.1
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.6	−60 09.1
6	Hamal	328 52.2	+23 14.6
48	Kaus Aust.	84 43.5	−34 24.6
40	Kochab	137 16.3	+74 20.6
57	Markab	14 23.6	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.7
24	Miapl'dus	221 49.5	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.1	−26 21.4
52	Peacock	54 30.1	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.1	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.9
44	Sabik	103 04.1	−15 40.3
3	Schedar	350 32.8	+56 16.8
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 13.6	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.7	−43 14.9
49	Vega	81 09.4	+38 44.0
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 22	23	24
h	m s	m s	m s
0	+ 1 22.9	+ 1 34.8	+ 1 46.3
6	+ 1 25.9	+ 1 37.7	+ 1 49.1
12	+ 1 28.9	+ 1 40.6	+ 1 51.8
18	+ 1 31.9	+ 1 43.4	+ 1 54.6
24	+ 1 34.8	+ 1 46.3	+ 1 57.3

Lat.	Sunrise	Twlt. begins	Moonrise 22	23	24	25
N °	h m	h m	h m	h m	h m	h m
72	2 52	////	9 36	11 55	13 53	15 46
70	3 16	////	10 11	12 11	13 59	15 43
68	3 35	////	10 36	12 23	14 03	15 41
66	3 50	////	10 55	12 34	14 07	15 40
64	4 02	////	11 10	12 42	14 11	15 38
62	4 12	////	11 22	12 49	14 14	15 37
60	4 21	////	11 33	12 56	14 16	15 36
58	4 29	1 14	11 42	13 01	14 18	15 35
56	4 35	1 48	11 50	13 06	14 20	15 34
54	4 42	2 12	11 57	13 11	14 22	15 33
52	4 47	2 29	12 04	13 14	14 24	15 33
50	4 52	2 44	12 10	13 18	14 25	15 32
45	5 02	3 12	12 22	13 26	14 28	15 31
40	5 11	3 33	12 32	13 32	14 31	15 30
35	5 19	3 49	12 41	13 38	14 33	15 29
30	5 25	4 01	12 48	13 42	14 35	15 28
20	5 36	4 21	13 01	13 51	14 39	15 27
10	5 46	4 34	13 13	13 58	14 42	15 25
0	5 55	4 45	13 23	14 05	14 45	15 24
10	6 04	4 53	13 34	14 12	14 48	15 23
20	6 13	4 59	13 45	14 19	14 51	15 22
30	6 24	5 03	13 58	14 27	14 54	15 21
35	6 30	5 04	14 05	14 32	14 56	15 20
40	6 37	5 05	14 14	14 37	14 58	15 19
45	6 44	5 05	14 24	14 43	15 01	15 18
50	6 54	5 04	14 35	14 50	15 04	15 17
52	6 58	5 04	14 41	14 54	15 05	15 17
54	7 03	5 02	14 47	14 58	15 07	15 16
56	7 09	5 01	14 53	15 02	15 09	15 15
58	7 14	5 00	15 00	15 06	15 11	15 15
60	7 21	4 59	15 09	15 11	15 13	15 14

Lat.	Sunset	Twlt. ends	Moonset 22	23	24	25
N °	h m	h m	h m	h m	h m	h m
72	21 10	////	5 10	4 19	3 46	3 17
70	20 44	////	4 33	4 01	3 37	3 16
68	20 25	////	4 07	3 46	3 30	3 15
66	20 10	////	3 47	3 34	3 24	3 14
64	19 57	////	3 31	3 24	3 19	3 13
62	19 46	////	3 17	3 16	3 14	3 12
60	19 37	////	3 05	3 08	3 10	3 12
58	19 30	22 53	2 55	3 02	3 07	3 11
56	19 23	22 16	2 47	2 56	3 04	3 11
54	19 17	21 51	2 39	2 51	3 01	3 10
52	19 11	21 32	2 32	2 46	2 59	3 10
50	19 06	21 17	2 25	2 42	2 56	3 09
45	18 55	20 47	2 11	2 32	2 51	3 09
40	18 46	20 26	2 00	2 25	2 47	3 08
35	18 39	20 10	1 50	2 18	2 43	3 07
30	18 32	19 57	1 42	2 12	2 40	3 06
20	18 21	19 38	1 27	2 02	2 34	3 06
10	18 11	19 23	1 13	1 52	2 29	3 05
0	18 02	19 13	1 01	1 44	2 24	3 04
10	17 53	19 04	0 49	1 35	2 19	3 03
20	17 43	18 57	0 35	1 26	2 14	3 02
30	17 33	18 53	0 20	1 15	2 08	3 01
35	17 26	18 51	0 11	1 08	2 05	3 00
40	17 19	18 50	0 00	1 01	2 01	2 59
45	17 11	18 49	24 53	0 53	1 56	2 58
50	17 02	18 50	24 43	0 43	1 50	2 57
52	16 57	18 50	24 38	0 38	1 48	2 57
54	16 53	18 52	24 33	0 33	1 45	2 56
56	16 47	18 52	24 27	0 27	1 42	2 56
58	16 41	18 53	24 20	0 20	1 38	2 55
60	16 34	18 55	24 13	0 13	1 34	2 54
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
22	19 34	10 57	13 24	13 35	23 28
23	20 15	10 52	13 23	13 32	23 23
24	20 54	10 47	13 22	13 28	23 19
25	21 34	10 42	13 21	13 25	23 15

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.5	0.1
30	0.2	0.4	0.0
45	0.2	0.3	0.0
60	0.2	0.2	0.0
75	0.2	0.1	0.0
90			

Moon's Lower Limb
Add

Alt.	22	23	24
°	′	′	′
0	12.2	12.0	11.9
4	12.3	12.0	11.9
8	12.3	12.0	11.9
12	12.3	12.1	11.9
16	12.4	12.1	12.0
20	12.4	12.2	12.1
24	12.5	12.3	12.2
28	12.6	12.4	12.2
32	12.7	12.5	12.4
36	12.8	12.6	12.5
40	12.9	12.7	12.6
44	13.0	12.8	12.7
48	13.2	13.0	12.9
52	13.3	13.1	13.1
56	13.5	13.3	13.2
60	13.6	13.5	13.4
64	13.8	13.6	13.6
68	14.0	13.8	13.8
72	14.1	14.0	14.0
76	14.3	14.2	14.2
80	14.5	14.4	14.4
84	14.7	14.6	14.6
88	14.8	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	22	23	24
°	′	′	′
0	17.4	17.6	17.7
4	17.4	17.6	17.6
8	17.4	17.5	17.6
12	17.4	17.5	17.6
16	17.3	17.5	17.5
20	17.3	17.4	17.5
24	17.2	17.3	17.4
28	17.1	17.2	17.3
32	17.0	17.1	17.2
36	16.9	17.0	17.0
40	16.8	16.9	16.9
44	16.6	16.7	16.8
48	16.5	16.6	16.6
52	16.4	16.4	16.5
56	16.2	16.3	16.3
60	16.1	16.1	16.1
64	15.9	15.9	15.9
68	15.7	15.7	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.0
88	14.9	14.8	14.8
90			

Subtract from table, back cover

GMT	♈	VENUS −3.7		MARS 1.7		JUPITER −1.6		SATURN 0.5		MOON			
	GHA	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
25 0	212 42.7	199 00.8	+10 49.1	159 32.0	+19 33.7	158 13.2	+18 43.8	10 15.8	− 6 25.5	45 12.2	170	+ 1 53.8	−134
1	227 45.2	214 03.9	48.2	174 32.7	34.1	173 15.1	44.0	25 18.4	25.4	59 48.2	170	1 40.4	−133
2	242 47.6	229 07.0	47.3	189 33.3	34.5	188 17.0	44.1	40 21.0	25.4	74 24.2	170	1 27.1	−134
3	257 50.1	244 10.2	•• 46.4	204 34.0	•• 35.0	203 18.9	•• 44.2	55 23.7	•• 25.3	89 00.2	170	• 1 13.7	−134
4	272 52.6	259 13.3	45.5	219 34.6	35.4	218 20.8	44.4	70 26.3	25.2	103 36.2	170	1 00.3	−134
5	287 55.0	274 16.4	44.6	234 35.3	35.9	233 22.7	44.5	85 28.9	25.2	118 12.2	169	0 46.9	−134
6	302 57.5	289 19.5	+10 43.7	249 36.0	+19 36.3	248 24.5	+18 44.6	100 31.6	− 6 25.1	132 48.1	170	+ 0 33.5	−134
7	318 00.0	304 22.6	42.8	264 36.6	36.7	263 26.4	44.8	115 34.2	25.0	147 24.1	170	0 20.1	−134
8	333 02.4	319 25.7	41.9	279 37.3	37.2	278 28.3	44.9	130 36.9	25.0	162 00.1	170	+ 0 06.7	−134
9	348 04.9	334 28.7	•• 41.0	294 37.9	•• 37.6	293 30.2	•• 45.0	145 39.5	•• 24.9	176 36.1	169	− 0 06.7	−134
10	3 07.4	349 31.8	40.1	309 38.6	38.1	308 32.1	45.2	160 42.1	24.8	191 12.0	170	0 20.1	−134
11	18 09.8	4 34.9	39.2	324 39.2	38.5	323 33.9	45.3	175 44.8	24.8	205 48.0	169	0 33.5	−134
12	33 12.3	19 38.0	+10 38.3	339 39.9	+19 38.9	338 35.8	+18 45.4	190 47.4	− 6 24.7	220 23.9	169	− 0 46.9	−134
13	48 14.8	34 41.1	37.4	354 40.6	39.4	353 37.7	45.6	205 50.1	24.6	234 59.8	169	1 00.3	−135
14	63 17.2	49 44.1	36.5	9 41.2	39.8	8 39.6	45.7	220 52.7	24.6	249 35.7	169	1 13.8	−134
15	78 19.7	64 47.2	•• 35.6	24 41.9	•• 40.3	23 41.5	•• 45.9	235 55.3	•• 24.5	264 11.6	169	• 1 27.2	−134
16	93 22.1	79 50.3	34.7	39 42.5	40.7	38 43.4	46.0	250 58.0	24.4	278 47.5	169	1 40.6	−134
17	108 24.6	94 53.3	33.8	54 43.2	41.1	53 45.2	46.1	266 00.6	24.4	293 23.4	168	1 54.0	−134
18	123 27.1	109 56.4	+10 33.0	69 43.8	+19 41.6	68 47.1	+18 46.3	281 03.2	− 6 24.3	307 59.2	169	− 2 07.4	−134
19	138 29.5	124 59.4	32.1	84 44.5	42.0	83 49.0	46.4	296 05.9	24.2	322 35.1	168	2 20.8	−135
20	153 32.0	140 02.5	31.2	99 45.2	42.4	98 50.9	46.5	311 08.5	24.2	337 10.9	168	2 34.3	−134
21	168 34.5	155 05.5	•• 30.3	114 45.8	•• 42.9	113 52.8	•• 46.7	326 11.2	•• 24.1	351 46.7	167	• 2 47.7	−134
22	183 36.9	170 08.6	29.4	129 46.5	43.3	128 54.6	46.8	341 13.8	24.0	6 22.4	168	3 01.1	−133
23	198 39.4	185 11.6	28.5	144 47.1	43.7	143 56.5	46.9	356 16.4	24.0	20 58.2	167	3 14.4	−134
26 0	213 41.9	200 14.6	+10 27.6	159 47.8	+19 44.2	158 58.4	+18 47.1	11 19.1	− 6 23.9	35 33.9	167	− 3 27.8	−134
1	228 44.3	215 17.7	26.8	174 48.4	44.6	174 00.3	47.2	26 21.7	23.8	50 09.6	167	3 41.2	−134
2	243 46.8	230 20.7	25.9	189 49.1	45.1	189 02.2	47.3	41 24.4	23.8	64 45.3	167	3 54.6	−133
3	258 49.2	245 23.7	•• 25.0	204 49.7	•• 45.5	204 04.0	•• 47.5	56 27.0	•• 23.7	79 21.0	166	• 4 07.9	−134
4	273 51.7	260 26.7	24.1	219 50.4	45.9	219 05.9	47.6	71 29.6	23.6	93 56.6	166	4 21.3	−133
5	288 54.2	275 29.7	23.3	234 51.1	46.4	234 07.8	47.8	86 32.3	23.6	108 32.2	166	4 34.6	−134
6	303 56.6	290 32.8	+10 22.4	249 51.7	+19 46.8	249 09.7	+18 47.9	101 34.9	− 6 23.5	123 07.8	165	− 4 48.0	−133
7	318 59.1	305 35.8	21.5	264 52.4	47.2	264 11.6	48.0	116 37.5	23.4	137 43.3	165	5 01.3	−133
8	334 01.6	320 38.8	20.7	279 53.0	47.7	279 13.4	48.2	131 40.2	23.4	152 18.8	165	5 14.6	−133
9	349 04.0	335 41.8	•• 19.8	294 53.7	•• 48.1	294 15.3	•• 48.3	146 42.8	•• 23.3	166 54.3	165	• 5 27.9	−133
10	4 06.5	350 44.8	18.9	309 54.3	48.5	309 17.2	48.4	161 45.5	23.2	181 29.8	164	5 41.2	−132
11	19 09.0	5 47.7	18.1	324 55.0	48.9	324 19.1	48.6	176 48.1	23.2	196 05.2	163	5 54.4	−133
12	34 11.4	20 50.7	+10 17.2	339 55.6	+19 49.4	339 21.0	+18 48.7	191 50.7	− 6 23.1	210 40.5	164	− 6 07.7	−132
13	49 13.9	35 53.7	16.3	354 56.3	49.8	354 22.8	48.8	206 53.4	23.1	225 15.9	163	6 20.9	−132
14	64 16.4	50 56.7	15.5	9 56.9	50.2	9 24.7	49.0	221 56.0	23.0	239 51.2	163	6 34.1	−132
15	79 18.8	65 59.7	•• 14.6	24 57.6	•• 50.7	24 26.6	•• 49.1	236 58.6	•• 22.9	254 26.5	162	• 6 47.3	−132
16	94 21.3	81 02.6	13.8	39 58.3	51.1	39 28.5	49.2	252 01.3	22.9	269 01.7	162	7 00.5	−131
17	109 23.7	96 05.6	12.9	54 58.9	51.5	54 30.4	49.4	267 03.9	22.8	283 36.9	161	7 13.6	−132
18	124 26.2	111 08.6	+10 12.1	69 59.6	+19 52.0	69 32.2	+18 49.5	282 06.6	− 6 22.7	298 12.0	162	− 7 26.8	−131
19	139 28.7	126 11.5	11.2	85 00.2	52.4	84 34.1	49.7	297 09.2	22.7	312 47.2	160	7 39.9	−131
20	154 31.1	141 14.5	10.3	100 00.9	52.8	99 36.0	49.8	312 11.8	22.6	327 22.2	160	7 53.0	−130
21	169 33.6	156 17.4	•• 09.5	115 01.5	•• 53.2	114 37.9	•• 49.9	327 14.5	•• 22.5	341 57.2	160	• 8 06.0	−131
22	184 36.1	171 20.4	08.7	130 02.2	53.7	129 39.8	50.1	342 17.1	22.5	356 32.2	160	8 19.1	−130
23	199 38.5	186 23.3	07.8	145 02.8	54.1	144 41.6	50.2	357 19.7	22.4	11 07.2	158	8 32.1	−130
27 0	214 41.0	201 26.3	+10 07.0	160 03.5	+19 54.5	159 43.5	+18 50.3	12 22.4	− 6 22.3	25 42.0	159	− 8 45.1	−130
1	229 43.5	216 29.2	06.1	175 04.1	55.0	174 45.4	50.5	27 25.0	22.3	40 16.9	158	8 58.1	−129
2	244 45.9	231 32.1	05.3	190 04.8	55.4	189 47.3	50.6	42 27.7	22.2	54 51.7	157	9 11.0	−129
3	259 48.4	246 35.1	•• 04.4	205 05.5	•• 55.8	204 49.2	•• 50.7	57 30.3	•• 22.1	69 26.4	157	• 9 23.9	−129
4	274 50.9	261 38.0	03.6	220 06.1	56.2	219 51.0	50.9	72 32.9	22.1	84 01.1	157	9 36.8	−128
5	289 53.3	276 40.9	02.8	235 06.8	56.7	234 52.9	51.0	87 35.6	22.0	98 35.8	156	9 49.6	−129
6	304 55.8	291 43.8	+10 01.9	250 07.4	+19 57.1	249 54.8	+18 51.1	102 38.2	− 6 21.9	113 10.4	155	−10 02.5	−127
7	319 58.2	306 46.8	01.1	265 08.1	57.5	264 56.7	51.3	117 40.8	21.9	127 44.9	155	10 15.2	−128
8	335 00.7	321 49.7	10 00.3	280 08.7	57.9	279 58.5	51.4	132 43.5	21.8	142 19.4	154	10 28.0	−127
9	350 03.2	336 52.6	• 9 59.4	295 09.4	•• 58.4	295 00.4	•• 51.5	147 46.1	•• 21.8	156 53.8	154	•10 40.7	−127
10	5 05.6	351 55.5	58.6	310 10.0	58.8	310 02.3	51.7	162 48.8	21.7	171 28.2	153	10 53.4	−126
11	20 08.1	6 58.4	57.8	325 10.7	59.2	325 04.2	51.8	177 51.4	21.6	186 02.5	153	11 06.0	−127
12	35 10.6	22 01.3	+ 9 57.0	340 11.3	+19 59.6	340 06.1	+18 51.9	192 54.0	− 6 21.6	200 36.8	152	−11 18.7	−125
13	50 13.0	37 04.2	56.1	355 12.0	20 00.1	355 07.9	52.1	207 56.7	21.5	215 11.0	151	11 31.2	−126
14	65 15.5	52 07.0	55.3	10 12.6	00.5	10 09.8	52.2	222 59.3	21.4	229 45.1	151	11 43.8	−125
15	80 18.0	67 09.9	•• 54.5	25 13.3	•• 00.9	25 11.7	•• 52.4	238 01.9	•• 21.4	244 19.2	150	•11 56.3	−124
16	95 20.4	82 12.8	53.7	40 13.9	01.3	40 13.6	52.5	253 04.6	21.3	258 53.2	150	12 08.7	−124
17	110 22.9	97 15.7	52.8	55 14.6	01.7	55 15.4	52.6	268 07.2	21.2	273 27.2	149	12 21.1	−124
18	125 25.3	112 18.6	+ 9 52.0	70 15.3	+20 02.2	70 17.3	+18 52.8	283 09.8	− 6 21.2	288 01.1	148	−12 33.5	−123
19	140 27.8	127 21.4	51.2	85 15.9	02.6	85 19.2	52.9	298 12.5	21.1	302 34.9	148	12 45.8	−123
20	155 30.3	142 24.3	50.4	100 16.6	03.0	100 21.1	53.0	313 15.1	21.0	317 08.7	147	12 58.1	−123
21	170 32.7	157 27.1	•• 49.6	115 17.2	•• 03.4	115 23.0	•• 53.2	328 17.8	•• 21.0	331 42.4	146	•13 10.4	−122
22	185 35.2	172 30.0	48.8	130 17.9	03.8	130 24.8	53.3	343 20.4	20.9	346 16.0	146	13 22.6	−121
23	200 37.7	187 32.8	48.0	145 18.5	04.3	145 26.7	53.4	358 23.0	20.8	0 49.6	145	13 34.7	−121
24	215 40.1	202 35.7	+ 9 47.2	160 19.2	+20 04.7	160 28.6	+18 53.6	13 25.7	− 6 20.8	15 23.1	144	−13 46.8	−121
code	−	+ 30	− 9	+ 7	+ 4	+ 18	+ 1	+ 27	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
25 0	180 29.4	+13 01.3
1	195 29.5	02.1
2	210 29.6	02.9
3	225 29.7	03.7
4	240 29.8	04.6
5	255 29.9	05.4
6	270 30.0	+13 06.2
7	285 30.2	07.0
8	300 30.3	07.8
9	315 30.4	08.6
10	330 30.5	09.5
11	345 30.6	10.3
12	0 30.7	+13 11.1
13	15 30.8	11.9
14	30 30.9	12.7
15	45 31.0	13.5
16	60 31.1	14.3
17	75 31.3	15.2
18	90 31.4	+13 16.0
19	105 31.5	16.8
20	120 31.6	17.6
21	135 31.7	18.4
22	150 31.8	19.2
23	165 31.9	20.0
26 0	180 32.0	+13 20.8
1	195 32.1	21.6
2	210 32.2	22.4
3	225 32.3	23.3
4	240 32.4	24.1
5	255 32.5	24.9
6	270 32.7	+13 25.7
7	285 32.8	26.5
8	300 32.9	27.3
9	315 33.0	28.1
10	330 33.1	28.9
11	345 33.2	29.7
12	0 33.3	+13 30.5
13	15 33.4	31.3
14	30 33.5	32.1
15	45 33.6	32.9
16	60 33.7	33.7
17	75 33.8	34.5
18	90 33.9	+13 35.3
19	105 34.0	36.2
20	120 34.1	37.0
21	135 34.2	37.8
22	150 34.3	38.6
23	165 34.4	39.4
27 0	180 34.5	+13 40.2
1	195 34.6	41.0
2	210 34.7	41.8
3	225 34.8	42.6
4	240 34.9	43.4
5	255 35.0	44.2
6	270 35.1	+13 45.0
7	285 35.2	45.8
8	300 35.3	46.6
9	315 35.4	47.3
10	330 35.5	48.1
11	345 35.6	48.9
12	0 35.7	+13 49.7
13	15 35.8	50.5
14	30 35.9	51.3
15	45 36.0	52.1
16	60 36.1	52.9
17	75 36.2	53.7
18	90 36.3	+13 54.5
19	105 36.4	55.3
20	120 36.5	56.1
21	135 36.6	56.9
22	150 36.7	57.7
23	165 36.8	58.5
24	180 36.9	+13 59.3
code	−	+ 8

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.3
30	Acrux	173 59.5	−62 50.7
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.4	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.6	+28 49.9
51	Altair	62 52.2	+ 8 44.4
2	Ankaa	354 00.4	−42 33.4
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.4	−68 56.7
22	Avior	234 36.7	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.5	−52 40.4
12	Capella	281 41.6	+45 57.4
53	Deneb	50 02.4	+45 06.4
28	Denebola	183 19.3	+14 49.9
4	Diphda	349 41.4	−18 14.5
27	Dubhe	194 46.2	+62 00.3
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.8	+51 29.3
54	Enif	34 31.5	+ 9 39.5
56	Fomalhaut	16 13.8	−29 52.1
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.6	−60 09.1
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 16.3	+74 20.6
57	Markab	14 23.5	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.6	−36 08.7
24	Miapl'dus	221 49.5	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.0	−26 21.4
52	Peacock	54 30.1	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.1	+12 35.3
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.1	−60 38.9
44	Sabik	103 04.1	−15 40.3
3	Schedar	350 32.8	+56 16.8
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.7	−43 14.9
49	Vega	81 09.3	+38 44.0
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 25	26	27
h	m s	m s	m s
0	+ 1 57.3	+ 2 07.8	+ 2 17.9
6	+ 2 00.0	+ 2 10.4	+ 2 20.3
12	+ 2 02.6	+ 2 12.9	+ 2 22.8
18	+ 2 05.2	+ 2 15.4	+ 2 25.1
24	+ 2 07.8	+ 2 17.9	+ 2 27.5

Lat.	Sunrise	Twlt. begins	Moonrise 25	26	27	28
N °	h m	h m	h m	h m	h m	h m
72	2 32	////	15 46	17 42	19 53	■
70	3 00	////	15 43	17 30	19 27	21 53
68	3 21	////	15 41	17 21	19 08	21 10
66	3 38	////	15 40	17 14	18 53	20 41
64	3 52	////	15 38	17 07	18 40	20 20
62	4 03	////	15 37	17 02	18 30	20 03
60	4 12	////	15 36	16 57	18 21	19 49
58	4 21	0 46	15 35	16 53	18 13	19 37
56	4 28	1 32	15 34	16 49	18 06	19 26
54	4 35	1 59	15 33	16 46	18 00	19 17
52	4 41	2 19	15 33	16 43	17 55	19 09
50	4 46	2 35	15 32	16 40	17 50	19 02
45	4 57	3 05	15 31	16 34	17 39	18 46
40	5 07	3 27	15 30	16 29	17 30	18 34
35	5 15	3 44	15 29	16 25	17 23	18 23
30	5 22	3 57	15 28	16 21	17 16	18 14
20	5 34	4 18	15 27	16 15	17 05	17 58
10	5 45	4 33	15 25	16 10	16 55	17 44
0	5 54	4 44	15 24	16 04	16 46	17 31
10	6 04	4 53	15 23	15 59	16 37	17 18
20	6 14	5 00	15 22	15 54	16 28	17 04
30	6 26	5 04	15 21	15 48	16 17	16 49
35	6 32	5 07	15 20	15 44	16 10	16 40
40	6 40	5 08	15 19	15 40	16 03	16 30
45	6 48	5 08	15 18	15 36	15 55	16 18
50	6 59	5 08	15 17	15 31	15 45	16 03
52	7 04	5 08	15 17	15 28	15 41	15 57
54	7 09	5 08	15 16	15 25	15 36	15 49
56	7 15	5 07	15 15	15 22	15 31	15 41
58	7 21	5 06	15 15	15 19	15 25	15 32
60	7 29	5 05	15 14	15 15	15 18	15 22
S						

Lat.	Sunset	Twlt. ends	Moonset 25	26	27	28
N °	h m	h m	h m	h m	h m	h m
72	21 29	////	3 17	2 50	2 19	1 37
70	20 59	////	3 16	2 56	2 33	2 05
68	20 37	////	3 15	3 00	2 45	2 25
66	20 20	////	3 14	3 04	2 54	2 42
64	20 06	////	3 13	3 08	3 02	2 56
62	19 55	////	3 12	3 11	3 09	3 08
60	19 45	////	3 12	3 13	3 15	3 18
58	19 36	23 27	3 11	3 15	3 20	3 26
56	19 29	22 32	3 11	3 17	3 25	3 34
54	19 22	22 02	3 10	3 19	3 29	3 41
52	19 16	21 41	3 10	3 21	3 33	3 47
50	19 11	21 25	3 09	3 22	3 37	3 53
45	18 59	20 53	3 09	3 26	3 44	4 05
40	18 49	20 30	3 08	3 29	3 51	4 15
35	18 41	20 13	3 07	3 31	3 56	4 24
30	18 34	20 00	3 06	3 33	4 01	4 31
20	18 22	19 39	3 06	3 37	4 10	4 45
10	18 11	19 24	3 05	3 40	4 17	4 56
0	18 01	19 12	3 04	3 43	4 24	5 07
10	17 52	19 03	3 03	3 47	4 31	5 18
20	17 41	18 56	3 02	3 50	4 39	5 30
30	17 30	18 51	3 01	3 54	4 48	5 44
35	17 23	18 48	3 00	3 56	4 53	5 52
40	17 15	18 46	2 59	3 58	4 59	6 00
45	17 07	18 46	2 58	4 01	5 05	6 11
50	16 56	18 45	2 57	4 05	5 13	6 24
52	16 51	18 45	2 57	4 06	5 17	6 30
54	16 46	18 45	2 56	4 08	5 21	6 37
56	16 40	18 46	2 56	4 10	5 26	6 44
58	16 34	18 47	2 55	4 12	5 31	6 53
60	16 26	18 47	2 54	4 15	5 37	7 02
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
25	21 34	10 42	13 21	13 25	23 15
26	22 14	10 37	13 20	13 22	23 11
27	22 57	10 32	13 19	13 19	23 06
28	23 42	10 28	13 18	13 16	23 02

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.5	0.1
30	0.2	0.4	0.0
45	0.2	0.3	0.0
60	0.2	0.2	0.0
75	0.2	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	25	26	27
°	′	′	′
0	12.0	12.2	12.6
4	12.0	12.3	12.6
8	12.0	12.3	12.7
12	12.1	12.3	12.7
16	12.1	12.4	12.7
20	12.2	12.4	12.8
24	12.3	12.5	12.9
28	12.4	12.6	12.9
32	12.5	12.7	13.0
36	12.6	12.8	13.1
40	12.7	12.9	13.2
44	12.8	13.0	13.3
48	13.0	13.2	13.4
52	13.1	13.3	13.6
56	13.3	13.5	13.7
60	13.5	13.6	13.8
64	13.6	13.8	14.0
68	13.8	14.0	14.1
72	14.0	14.1	14.3
76	14.2	14.3	14.4
80	14.4	14.5	14.6
84	14.6	14.7	14.8
88	14.7	14.8	14.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	25	26	27
°	′	′	′
0	17.6	17.4	17.2
4	17.6	17.4	17.2
8	17.5	17.4	17.2
12	17.5	17.4	17.2
16	17.5	17.3	17.1
20	17.4	17.3	17.1
24	17.3	17.2	17.0
28	17.2	17.1	16.9
32	17.1	17.0	16.8
36	17.0	16.9	16.7
40	16.9	16.8	16.6
44	16.7	16.6	16.5
48	16.6	16.5	16.4
52	16.4	16.4	16.3
56	16.3	16.2	16.1
60	16.1	16.1	16.0
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.1
88	14.8	14.9	15.0
90			

Subtract from table, back cover

918768°—52——6

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
28 0	215 40.1	202 35.7	+ 9 47.2	160 19.2	+20 04.7	160 28.6	+18 53.6	13 25.7	− 6 20.8	15 23.1	144	−13 46.8	−121
1	230 42.6	217 38.5	46.4	175 19.8	05.1	175 30.5	53.7	28 28.3	20.7	29 56.5	144	13 58.9	−120
2	245 45.1	232 41.4	45.6	190 20.5	05.5	190 32.3	53.8	43 30.9	20.7	44 29.9	143	14 10.9	−119
3	260 47.5	247 44.2	·· 44.8	205 21.1	·· 05.9	205 34.2	·· 54.0	58 33.6	·· 20.6	59 03.2	142	·14 22.8	−119
4	275 50.0	262 47.1	44.0	220 21.8	06.4	220 36.1	54.1	73 36.2	20.5	73 36.4	142	14 34.7	−118
5	290 52.5	277 49.9	43.2	235 22.4	06.8	235 38.0	54.2	88 38.8	20.5	88 09.6	141	14 46.5	−118
6	305 54.9	292 52.7	+ 9 42.4	250 23.1	+20 07.2	250 39.8	+18 54.4	103 41.5	− 6 20.4	102 42.7	140	−14 58.3	−118
7	320 57.4	307 55.5	41.6	265 23.7	07.6	265 41.7	54.5	118 44.1	20.3	117 15.7	139	15 10.1	−116
8	335 59.8	322 58.3	40.8	280 24.4	08.0	280 43.6	54.6	133 46.7	20.3	131 48.6	139	15 21.7	−116
9	351 02.3	338 01.2	·· 40.0	295 25.0	·· 08.5	295 45.5	·· 54.8	148 49.4	·· 20.2	146 21.5	138	·15 33.3	−116
10	6 04.8	353 04.0	39.2	310 25.7	08.9	310 47.4	54.9	163 52.0	20.1	160 54.3	137	15 44.9	−115
11	21 07.2	8 06.8	38.4	325 26.3	09.3	325 49.2	55.0	178 54.7	20.1	175 27.0	137	15 56.4	−114
12	36 09.7	23 09.6	+ 9 37.6	340 27.0	+20 09.7	340 51.1	+18 55.2	193 57.3	− 6 20.0	189 59.7	135	−16 07.8	−114
13	51 12.2	38 12.4	36.8	355 27.6	10.1	355 53.0	55.3	208 59.9	19.9	204 32.2	135	16 19.2	−113
14	66 14.6	53 15.2	36.1	10 28.3	10.5	10 54.9	55.4	224 02.6	19.9	219 04.7	134	16 30.5	−113
15	81 17.1	68 17.9	·· 35.3	25 28.9	·· 10.9	25 56.7	·· 55.6	239 05.2	·· 19.8	233 37.1	133	·16 41.8	−111
16	96 19.6	83 20.7	34.5	40 29.6	11.4	40 58.6	55.7	254 07.8	19.8	248 09.4	133	16 52.9	−112
17	111 22.0	98 23.5	33.7	55 30.2	11.8	56 00.5	55.8	269 10.5	19.7	262 41.7	131	17 04.1	−110
18	126 24.5	113 26.3	+ 9 32.9	70 30.9	+20 12.2	71 02.4	+18 56.0	284 13.1	− 6 19.6	277 13.8	131	−17 15.1	−110
19	141 26.9	128 29.1	32.2	85 31.5	12.6	86 04.2	56.1	299 15.7	19.6	291 45.9	130	17 26.1	−109
20	156 29.4	143 31.8	31.4	100 32.2	13.0	101 06.1	56.2	314 18.4	19.5	306 17.9	130	17 37.0	−108
21	171 31.9	158 34.6	·· 30.6	115 32.8	·· 13.4	116 08.0	·· 56.4	329 21.0	·· 19.4	320 49.9	128	·17 47.8	−108
22	186 34.3	173 37.4	29.9	130 33.5	13.8	131 09.9	56.5	344 23.6	19.4	335 21.7	128	17 58.6	−107
23	201 36.8	188 40.1	29.1	145 34.1	14.2	146 11.7	56.7	359 26.3	19.3	349 53.5	126	18 09.3	−106
29 0	216 39.3	203 42.9	+ 9 28.3	160 34.8	+20 14.7	161 13.6	+18 56.8	14 28.9	− 6 19.2	4 25.1	126	−18 19.9	−105
1	231 41.7	218 45.6	27.6	175 35.5	15.1	176 15.5	56.9	29 31.5	19.2	18 56.7	126	18 30.4	−105
2	246 44.2	233 48.4	26.8	190 36.1	15.5	191 17.4	57.1	44 34.2	19.1	33 28.3	124	18 40.9	−104
3	261 46.7	248 51.1	·· 26.0	205 36.8	·· 15.9	206 19.2	·· 57.2	59 36.8	·· 19.1	47 59.7	123	·18 51.3	−103
4	276 49.1	263 53.9	25.3	220 37.4	16.3	221 21.1	57.3	74 39.4	19.0	62 31.0	123	19 01.6	−102
5	291 51.6	278 56.6	24.5	235 38.1	16.7	236 23.0	57.5	89 42.1	18.9	77 02.3	121	19 11.8	−101
6	306 54.1	293 59.3	+ 9 23.8	250 38.7	+20 17.1	251 24.9	+18 57.6	104 44.7	− 6 18.9	91 33.4	121	−19 21.9	−101
7	321 56.5	309 02.1	23.0	265 39.4	17.5	266 26.7	57.7	119 47.3	18.8	106 04.5	120	19 32.0	−100
8	336 59.0	324 04.8	22.3	280 40.0	17.9	281 28.6	57.9	134 50.0	18.7	120 35.5	119	19 42.0	− 98
9	352 01.4	339 07.5	·· 21.5	295 40.6	·· 18.4	296 30.5	·· 58.0	149 52.6	·· 18.7	135 06.4	119	·19 51.8	− 99
10	7 03.9	354 10.2	20.8	310 41.3	18.8	311 32.4	58.1	164 55.3	18.6	149 37.3	117	20 01.7	− 97
11	22 06.4	9 12.9	20.0	325 41.9	19.2	326 34.2	58.3	179 57.9	18.5	164 08.0	116	20 11.4	− 96
12	37 08.8	24 15.6	+ 9 19.3	340 42.6	+20 19.6	341 36.1	+18 58.4	195 00.5	− 6 18.5	178 38.6	116	−20 21.0	− 95
13	52 11.3	39 18.3	18.5	355 43.2	20.0	356 38.0	58.5	210 03.2	18.4	193 09.2	115	20 30.5	− 95
14	67 13.8	54 21.0	17.8	10 43.9	20.4	11 39.9	58.7	225 05.8	18.4	207 39.7	114	20 40.0	− 93
15	82 16.2	69 23.7	·· 17.1	25 44.5	·· 20.8	26 41.7	·· 58.8	240 08.4	·· 18.3	222 10.1	113	·20 49.3	− 93
16	97 18.7	84 26.4	16.3	40 45.2	21.2	41 43.6	58.9	255 11.1	18.2	236 40.4	112	20 58.6	− 91
17	112 21.2	99 29.1	15.6	55 45.8	21.6	56 45.5	59.1	270 13.7	18.2	251 10.6	111	21 07.7	− 91
18	127 23.6	114 31.8	+ 9 14.9	70 46.5	+20 22.0	71 47.4	+18 59.2	285 16.3	− 6 18.1	265 40.7	110	−21 16.8	− 90
19	142 26.1	129 34.5	14.1	85 47.1	22.4	86 49.2	59.3	300 19.0	18.0	280 10.7	110	21 25.8	− 88
20	157 28.6	144 37.1	13.4	100 47.8	22.8	101 51.1	59.5	315 21.6	18.0	294 40.7	108	21 34.6	− 88
21	172 31.0	159 39.8	·· 12.7	115 48.4	·· 23.2	116 53.0	·· 59.6	330 24.2	·· 17.9	309 10.5	108	·21 43.4	− 87
22	187 33.5	174 42.5	11.9	130 49.1	23.6	131 54.9	59.7	345 26.9	17.9	323 40.3	107	21 52.1	− 85
23	202 35.9	189 45.2	11.2	145 49.7	24.0	146 56.7	18 59.9	0 29.5	17.8	338 10.0	106	22 00.6	− 85
30 0	217 38.4	204 47.8	+ 9 10.5	160 50.4	+20 24.4	161 58.6	+19 00.0	15 32.1	− 6 17.7	352 39.6	105	−22 09.1	− 84
1	232 40.9	219 50.5	09.8	175 51.0	24.8	177 00.5	00.1	30 34.8	17.7	7 09.1	104	22 17.5	− 82
2	247 43.3	234 53.1	09.1	190 51.7	25.3	192 02.4	00.3	45 37.4	17.6	21 38.5	103	22 25.7	− 82
3	262 45.8	249 55.8	·· 08.3	205 52.3	·· 25.7	207 04.2	·· 00.4	60 40.0	·· 17.5	36 07.8	103	·22 33.9	− 80
4	277 48.3	264 58.4	07.6	220 53.0	26.1	222 06.1	00.5	75 42.7	17.5	50 37.1	101	22 41.9	− 79
5	292 50.7	280 01.1	06.9	235 53.6	26.5	237 08.0	00.7	90 45.3	17.4	65 06.2	101	22 49.8	− 78
6	307 53.2	295 03.7	+ 9 06.2	250 54.3	+20 26.9	252 09.9	+19 00.8	105 47.9	− 6 17.3	79 35.3	100	−22 57.6	− 77
7	322 55.7	310 06.3	05.5	265 54.9	27.3	267 11.7	00.9	120 50.6	17.3	94 04.3	98	23 05.3	− 76
8	337 58.1	325 09.0	04.8	280 55.6	27.7	282 13.6	01.1	135 53.2	17.2	108 33.1	99	23 12.9	− 75
9	353 00.6	340 11.6	·· 04.1	295 56.2	·· 28.1	297 15.5	·· 01.2	150 55.8	·· 17.2	123 02.0	97	·23 20.4	− 74
10	8 03.0	355 14.2	03.4	310 56.9	28.5	312 17.3	01.3	165 58.5	17.1	137 30.7	96	23 27.8	− 72
11	23 05.5	10 16.8	02.7	325 57.5	28.9	327 19.2	01.5	181 01.1	17.0	151 59.3	96	23 35.0	− 71
12	38 08.0	25 19.4	+ 9 02.0	340 58.2	+20 29.3	342 21.1	+19 01.6	196 03.7	− 6 17.0	166 27.9	94	−23 42.1	− 70
13	53 10.4	40 22.1	01.3	355 58.8	29.7	357 23.0	01.7	211 06.4	16.9	180 56.3	94	23 49.1	− 69
14	68 12.9	55 24.7	9 00.6	10 59.5	30.1	12 24.8	01.9	226 09.0	16.8	195 24.7	93	23 56.0	− 68
15	83 15.4	70 27.3	· 8 59.9	26 00.1	·· 30.5	27 26.7	·· 02.0	241 11.6	·· 16.8	209 53.0	92	·24 02.8	− 66
16	98 17.8	85 29.9	59.2	41 00.8	30.9	42 28.6	02.1	256 14.3	16.7	224 21.2	92	24 09.4	− 66
17	113 20.3	100 32.5	58.5	56 01.4	31.3	57 30.5	02.3	271 16.9	16.7	238 49.4	90	24 16.0	− 64
18	128 22.8	115 35.1	+ 8 57.8	71 02.0	+20 31.7	72 32.3	+19 02.4	286 19.5	− 6 16.6	253 17.4	90	−24 22.4	− 62
19	143 25.2	130 37.6	57.1	86 02.7	32.1	87 34.2	02.5	301 22.1	16.5	267 45.4	89	24 28.6	− 62
20	158 27.7	145 40.2	56.4	101 03.3	32.5	102 36.1	02.7	316 24.8	16.5	282 13.3	88	24 34.8	− 60
21	173 30.2	160 42.8	·· 55.7	116 04.0	·· 32.8	117 38.0	·· 02.8	331 27.4	·· 16.4	296 41.1	87	·24 40.8	− 59
22	188 32.6	175 45.4	55.1	131 04.6	33.2	132 39.8	02.9	346 30.0	16.3	311 08.8	87	24 46.7	− 57
23	203 35.1	190 47.9	54.4	146 05.3	33.6	147 41.7	03.1	1 32.7	16.3	325 36.5	86	24 52.4	− 56
24	218 37.5	205 50.5	+ 8 53.7	161 05.9	+20 34.0	162 43.6	+19 03.2	16 35.3	− 6 16.2	340 04.1	85	−24 58.0	− 55
code	−	+ 27	− 8	+ 6	+ 4	+ 19	+ 1	+ 27	+ 1				

GMT	SUN GHA	SUN Dec.
28 h 0	180 36.9	+13 59.3
1	195 37.0	14 00.1
2	210 37.1	00.8
3	225 37.2	01.6
4	240 37.3	02.4
5	255 37.4	03.2
6	270 37.5	+14 04.0
7	285 37.6	04.8
8	300 37.7	05.6
9	315 37.8	06.4
10	330 37.9	07.2
11	345 38.0	07.9
12	0 38.1	+14 08.7
13	15 38.2	09.5
14	30 38.3	10.3
15	45 38.4	11.1
16	60 38.4	11.9
17	75 38.5	12.7
18	90 38.6	+14 13.4
19	105 38.7	14.2
20	120 38.8	15.0
21	135 38.9	15.8
22	150 39.0	16.6
23	165 39.1	17.4
29 0	180 39.2	+14 18.1
1	195 39.3	18.9
2	210 39.4	19.7
3	225 39.5	20.5
4	240 39.5	21.3
5	255 39.6	22.0
6	270 39.7	+14 22.8
7	285 39.8	23.6
8	300 39.9	24.4
9	315 40.0	25.2
10	330 40.1	25.9
11	345 40.2	26.7
12	0 40.3	+14 27.5
13	15 40.4	28.3
14	30 40.5	29.0
15	45 40.5	29.8
16	60 40.6	30.6
17	75 40.7	31.4
18	90 40.8	+14 32.1
19	105 40.9	32.9
20	120 41.0	33.7
21	135 41.1	34.5
22	150 41.2	35.2
23	165 41.2	36.0
30 0	180 41.3	+14 36.8
1	195 41.4	37.5
2	210 41.5	38.3
3	225 41.6	39.1
4	240 41.7	39.9
5	255 41.8	40.6
6	270 41.8	+14 41.4
7	285 41.9	42.2
8	300 42.0	42.9
9	315 42.1	43.7
10	330 42.2	44.5
11	345 42.3	45.2
12	0 42.3	+14 46.0
13	15 42.4	46.8
14	30 42.5	47.5
15	45 42.6	48.3
16	60 42.7	49.1
17	75 42.8	49.8
18	90 42.8	+14 50.6
19	105 42.9	51.4
20	120 43.0	52.1
21	135 43.1	52.9
22	150 43.2	53.6
23	165 43.2	54.4
24	180 43.3	+14 55.2
code	−	+ 8

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.3
30	Acrux	173 59.5	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.7
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.3	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.6	+28 49.9
51	Altair	62 52.2	+ 8 44.4
2	Ankaa	354 00.4	−42 33.4
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.4	−68 56.7
22	Avior	234 36.7	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.5	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.3	+45 06.4
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.4	−18 14.5
27	Dubhe	194 46.3	+62 00.3
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.8	+51 29.3
54	Enif	34 31.5	+ 9 39.5
56	Fomalhaut	16 13.8	−29 52.1
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.5	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 16.3	+74 20.6
57	Markab	14 23.5	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.5	−36 08.7
24	Miapl'dus	221 49.6	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.0	−26 21.4
52	Peacock	54 30.0	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.1	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.0	−60 38.9
44	Sabik	103 04.0	−15 40.3
3	Schedar	350 32.8	+56 16.8
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.7	−43 14.9
49	Vega	81 09.3	+38 44.0
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 28	29	30
h	m s	m s	m s
0	+ 2 27.5	+ 2 36.6	+ 2 45.1
6	+ 2 29.8	+ 2 38.7	+ 2 47.2
12	+ 2 32.1	+ 2 40.9	+ 2 49.2
18	+ 2 34.3	+ 2 43.0	+ 2 51.2
24	+ 2 36.6	+ 2 45.1	+ 2 53.2

Lat.	Sunrise	Twlt. begins	Moonrise 28	29	30	1
N °	h m	h m	h m	h m	h m	h m
72	2 10	////	▬	▬	▬	▬
70	2 44	////	21 53	▬	▬	▬
68	3 08	////	21 10	▬	▬	▬
66	3 26	////	20 41	22 50	▬	▬
64	3 41	////	20 20	22 09	24 16	0 16
62	3 54	////	20 03	21 42	23 24	24 59
60	4 04	////	19 49	21 20	22 53	24 15
58	4 13	////	19 37	21 03	22 29	23 46
56	4 21	1 13	19 26	20 49	22 10	23 24
54	4 28	1 46	19 17	20 36	21 54	23 05
52	4 35	2 08	19 09	20 25	21 40	22 50
50	4 41	2 26	19 02	20 15	21 28	22 36
45	4 53	2 58	18 46	19 55	21 04	22 09
40	5 03	3 22	18 34	19 39	20 44	21 47
35	5 12	3 40	18 23	19 25	20 28	21 29
30	5 19	3 54	18 14	19 13	20 14	21 14
20	5 32	4 16	17 58	18 52	19 50	20 48
10	5 44	4 31	17 44	18 35	19 29	20 25
0	5 54	4 43	17 31	18 18	19 10	20 05
10	6 04	4 52	17 18	18 02	18 51	19 44
20	6 15	5 00	17 04	17 45	18 30	19 22
30	6 27	5 06	16 49	17 25	18 07	18 56
35	6 34	5 08	16 40	17 13	17 53	18 41
40	6 42	5 10	16 30	17 00	17 38	18 23
45	6 52	5 12	16 18	16 45	17 19	18 02
50	7 03	5 13	16 03	16 26	16 56	17 36
52	7 08	5 13	15 57	16 17	16 45	17 23
54	7 14	5 12	15 49	16 07	16 32	17 08
56	7 20	5 13	15 41	15 56	16 18	16 51
58	7 27	5 12	15 32	15 43	16 01	16 30
60	7 35	5 12	15 22	15 28	15 40	16 04
S						

Lat.	Sunset	Twlt. ends	Moonset 28	29	30	1
N °	h m	h m	h m	h m	h m	h m
72	21 51	////	1 37	▬	▬	▬
70	21 15	////	2 05	1 13	▬	▬
68	20 50	////	2 25	1 57	▬	▬
66	20 31	////	2 42	2 27	1 59	▬
64	20 16	////	2 56	2 49	2 40	2 22
62	20 03	////	3 08	3 07	3 08	3 14
60	19 52	////	3 18	3 22	3 30	3 46
58	19 43	////	3 26	3 35	3 48	4 10
56	19 35	22 51	3 34	3 46	4 03	4 30
54	19 28	22 16	3 41	3 56	4 16	4 46
52	19 21	21 51	3 47	4 04	4 28	5 00
50	19 15	21 33	3 53	4 12	4 38	5 12
45	19 03	20 59	4 05	4 29	4 59	5 37
40	18 52	20 35	4 15	4 43	5 17	5 58
35	18 44	20 17	4 24	4 55	5 31	6 15
30	18 36	20 03	4 31	5 05	5 44	6 29
20	18 23	19 41	4 45	5 23	6 06	6 54
10	18 11	19 24	4 56	5 38	6 25	7 16
0	18 01	19 12	5 07	5 53	6 43	7 36
10	17 50	19 02	5 18	6 08	7 01	7 56
20	17 39	18 54	5 30	6 24	7 20	8 18
30	17 27	18 48	5 44	6 42	7 42	8 43
35	17 20	18 46	5 52	6 52	7 55	8 57
40	17 12	18 44	6 00	7 05	8 10	9 15
45	17 02	18 41	6 11	7 19	8 28	9 35
50	16 51	18 41	6 24	7 37	8 50	10 01
52	16 46	18 41	6 30	7 45	9 01	10 14
54	16 40	18 40	6 37	7 55	9 13	10 28
56	16 34	18 41	6 44	8 05	9 27	10 45
58	16 27	18 41	6 53	8 17	9 44	11 06
60	16 18	18 41	7 02	8 32	10 04	11 32
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
28	23 42	10 28	13 18	13 16	23 02
29	24 30	10 23	13 17	13 13	22 58
30	0 30	10 19	13 16	13 10	22 54
1	1 23	10 15	13 15	13 08	22 50

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.4	0.1
30	0.2	0.4	0.0
45	0.2	0.3	0.0
60	0.2	0.2	0.0
75	0.2	0.1	0.0
90			

Moon's Lower Limb **Add**

Alt.	28	29	30
°	′	′	′
0	13.1	13.8	14.3
4	13.1	13.8	14.3
8	13.2	13.8	14.3
12	13.2	13.8	14.3
16	13.2	13.8	14.3
20	13.3	13.9	14.4
24	13.3	13.9	14.4
28	13.4	14.0	14.4
32	13.5	14.0	14.4
36	13.5	14.1	14.5
40	13.6	14.1	14.5
44	13.7	14.2	14.6
48	13.8	14.3	14.6
52	13.9	14.3	14.7
56	14.0	14.4	14.7
60	14.1	14.5	14.8
64	14.3	14.6	14.9
68	14.4	14.7	14.9
72	14.5	14.8	15.0
76	14.6	14.9	15.1
80	14.8	15.0	15.1
84	14.9	15.1	15.2
88	15.0	15.1	15.3
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	28	29	30
°	′	′	′
0	16.9	16.6	16.3
4	16.9	16.6	16.3
8	16.9	16.5	16.3
12	16.9	16.5	16.2
16	16.8	16.5	16.2
20	16.8	16.5	16.2
24	16.7	16.4	16.2
28	16.7	16.4	16.1
32	16.6	16.3	16.1
36	16.5	16.3	16.1
40	16.4	16.2	16.0
44	16.4	16.1	16.0
48	16.3	16.1	15.9
52	16.2	16.0	15.9
56	16.0	15.9	15.8
60	15.9	15.8	15.7
64	15.8	15.7	15.7
68	15.7	15.6	15.6
72	15.6	15.6	15.6
76	15.4	15.5	15.5
80	15.3	15.4	15.4
84	15.2	15.3	15.3
88	15.1	15.2	15.3
90			

Subtract from table, back cover

Full Moon 29

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.5 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
1 0	218 37.5	205 50.5	+ 8 53.7	161 05.9	+20 34.0	162 43.6	+19 03.2	16 35.3	− 6 16.2	340 04.1	85	−24 58.0	− 55
1	233 40.0	220 53.1	53.0	176 06.6	34.4	177 45.4	03.3	31 37.9	16.2	354 31.6	84	25 03.5	− 54
2	248 42.5	235 55.6	52.4	191 07.2	34.8	192 47.3	03.5	46 40.6	16.1	8 59.0	83	25 08.9	− 52
3	263 44.9	250 58.2	•• 51.7	206 07.9	•• 35.2	207 49.2	•• 03.6	61 43.2	•• 16.0	23 26.3	83	•25 14.1	− 51
4	278 47.4	266 00.7	51.0	221 08.5	35.6	222 51.1	03.7	76 45.8	16.0	37 53.6	82	25 19.2	− 49
5	293 49.9	281 03.3	50.3	236 09.2	36.0	237 52.9	03.9	91 48.5	15.9	52 20.8	82	25 24.1	− 49
6	308 52.3	296 05.8	+ 8 49.7	251 09.8	+20 36.4	252 54.8	+19 04.0	106 51.1	− 6 15.9	66 48.0	80	−25 29.0	− 46
7	323 54.8	311 08.4	49.0	266 10.5	36.8	267 56.7	04.1	121 53.7	15.8	81 15.0	80	25 33.6	− 46
8	338 57.3	326 10.9	48.4	281 11.1	37.2	282 58.5	04.3	136 56.4	15.7	95 42.0	80	25 38.2	− 44
9	353 59.7	341 13.5	•• 47.7	296 11.7	•• 37.6	298 00.4	•• 04.4	151 59.0	•• 15.7	110 09.0	78	•25 42.6	− 42
10	9 02.2	356 16.0	47.0	311 12.4	38.0	313 02.3	04.5	167 01.6	15.6	124 35.8	78	25 46.8	− 41
11	24 04.7	11 18.5	46.4	326 13.0	38.4	328 04.2	04.6	182 04.3	15.5	139 02.6	77	25 50.9	− 40
12	39 07.1	26 21.0	+ 8 45.7	341 13.7	+20 38.8	343 06.0	+19 04.8	197 06.9	− 6 15.5	153 29.3	77	−25 54.9	− 38
13	54 09.6	41 23.5	45.1	356 14.3	39.2	358 07.9	04.9	212 09.5	15.4	167 56.0	76	25 58.7	− 37
14	69 12.0	56 26.1	44.4	11 15.0	39.5	13 09.8	05.0	227 12.2	15.4	182 22.6	76	26 02.4	− 35
15	84 14.5	71 28.6	•• 43.8	26 15.6	•• 39.9	28 11.7	•• 05.2	242 14.8	•• 15.3	196 49.2	74	•26 05.9	− 34
16	99 17.0	86 31.1	43.1	41 16.3	40.3	43 13.5	05.3	257 17.4	15.2	211 15.6	75	26 09.3	− 32
17	114 19.4	101 33.6	42.5	56 16.9	40.7	58 15.4	05.4	272 20.0	15.2	225 42.1	73	26 12.5	− 31
18	129 21.9	116 36.1	+ 8 41.8	71 17.6	+20 41.1	73 17.3	+19 05.6	287 22.7	− 6 15.1	240 08.4	73	−26 15.6	− 30
19	144 24.4	131 38.6	41.2	86 18.2	41.5	88 19.1	05.7	302 25.3	15.0	254 34.7	73	26 18.6	− 28
20	159 26.8	146 41.1	40.5	101 18.9	41.9	103 21.0	05.8	317 27.9	15.0	269 01.0	72	26 21.4	− 26
21	174 29.3	161 43.5	•• 39.9	116 19.5	•• 42.3	118 22.9	•• 06.0	332 30.6	•• 14.9	283 27.2	72	•26 24.0	− 25
22	189 31.8	176 46.0	39.3	131 20.1	42.7	133 24.7	06.1	347 33.2	14.9	297 53.4	71	26 26.5	− 23
23	204 34.2	191 48.5	38.6	146 20.8	43.1	148 26.6	06.2	2 35.8	14.8	312 19.5	70	26 28.8	− 22
2 0	219 36.7	206 51.0	+ 8 38.0	161 21.4	+20 43.4	163 28.5	+19 06.4	17 38.5	− 6 14.7	326 45.5	70	−26 31.0	− 21
1	234 39.2	221 53.5	37.4	176 22.1	43.8	178 30.4	06.5	32 41.1	14.7	341 11.5	70	26 33.1	− 18
2	249 41.6	236 55.9	36.8	191 22.7	44.2	193 32.2	06.6	47 43.7	14.6	355 37.5	69	26 34.9	− 18
3	264 44.1	251 58.4	•• 36.1	206 23.4	•• 44.6	208 34.1	•• 06.8	62 46.3	•• 14.6	10 03.4	69	•26 36.7	− 15
4	279 46.5	267 00.8	35.5	221 24.0	45.0	223 36.0	06.9	77 49.0	14.5	24 29.3	69	26 38.2	− 14
5	294 49.0	282 03.3	34.9	236 24.7	45.4	238 37.8	07.0	92 51.6	14.4	38 55.2	68	26 39.6	− 13
6	309 51.5	297 05.8	+ 8 34.3	251 25.3	+20 45.8	253 39.7	+19 07.2	107 54.2	− 6 14.4	53 21.0	67	−26 40.9	− 11
7	324 53.9	312 08.2	33.6	266 25.9	46.1	268 41.6	07.3	122 56.9	14.3	67 46.7	68	26 42.0	− 9
8	339 56.4	327 10.7	33.0	281 26.6	46.5	283 43.5	07.4	137 59.5	14.3	82 12.5	67	26 42.9	− 8
9	354 58.9	342 13.1	•• 32.4	296 27.2	•• 46.9	298 45.3	•• 07.6	153 02.1	•• 14.2	96 38.2	66	•26 43.7	− 7
10	10 01.3	357 15.5	31.8	311 27.9	47.3	313 47.2	07.7	168 04.8	14.1	111 03.8	67	26 44.4	− 4
11	25 03.8	12 18.0	31.2	326 28.5	47.7	328 49.1	07.8	183 07.4	14.1	125 29.5	66	26 44.8	− 3
12	40 06.3	27 20.4	+ 8 30.6	341 29.2	+20 48.1	343 50.9	+19 08.0	198 10.0	− 6 14.0	139 55.1	65	−26 45.1	− 2
13	55 08.7	42 22.8	30.0	356 29.8	48.5	358 52.8	08.1	213 12.6	13.9	154 20.6	66	26 45.3	0
14	70 11.2	57 25.2	29.4	11 30.5	48.8	13 54.7	08.2	228 15.3	13.9	168 46.2	65	26 45.3	+ 2
15	85 13.7	72 27.7	•• 28.8	26 31.1	•• 49.2	28 56.5	•• 08.4	243 17.9	•• 13.8	183 11.7	65	•26 45.1	+ 3
16	100 16.1	87 30.1	28.2	41 31.7	49.6	43 58.4	08.5	258 20.5	13.8	197 37.2	65	26 44.8	+ 5
17	115 18.6	102 32.5	27.6	56 32.4	50.0	59 00.3	08.6	273 23.2	13.7	212 02.7	65	26 44.3	+ 7
18	130 21.0	117 34.9	+ 8 27.0	71 33.0	+20 50.4	74 02.2	+19 08.7	288 25.8	− 6 13.6	226 28.2	65	−26 43.6	+ 8
19	145 23.5	132 37.3	26.4	86 33.7	50.7	89 04.0	08.9	303 28.4	13.6	240 53.7	64	26 42.8	+ 9
20	160 26.0	147 39.7	25.8	101 34.3	51.1	104 05.9	09.0	318 31.1	13.5	255 19.1	64	26 41.9	+ 12
21	175 28.4	162 42.1	•• 25.2	116 35.0	•• 51.5	119 07.8	•• 09.1	333 33.7	•• 13.5	269 44.5	64	•26 40.7	+ 13
22	190 30.9	177 44.5	24.6	131 35.6	51.9	134 09.6	09.3	348 36.3	13.4	284 09.9	64	26 39.4	+ 14
23	205 33.4	192 46.9	24.0	146 36.2	52.3	149 11.5	09.4	3 38.9	13.3	298 35.3	64	26 38.0	+ 16
3 0	220 35.8	207 49.3	+ 8 23.4	161 36.9	+20 52.6	164 13.4	+19 09.5	18 41.6	− 6 13.3	313 00.7	64	−26 36.4	+ 18
1	235 38.3	222 51.6	22.8	176 37.5	53.0	179 15.2	09.7	33 44.2	13.2	327 26.1	64	26 34.6	+ 19
2	250 40.8	237 54.0	22.3	191 38.2	53.4	194 17.1	09.8	48 46.8	13.2	341 51.5	64	26 32.7	+ 21
3	265 43.2	252 56.4	•• 21.7	206 38.8	•• 53.8	209 19.0	•• 09.9	63 49.5	•• 13.1	356 16.9	64	•26 30.6	+ 23
4	280 45.7	267 58.7	21.1	221 39.5	54.2	224 20.9	10.1	78 52.1	13.0	10 42.3	64	26 28.3	+ 24
5	295 48.1	283 01.1	20.5	236 40.1	54.5	239 22.7	10.2	93 54.7	13.0	25 07.7	64	26 25.9	+ 26
6	310 50.6	298 03.5	+ 8 19.9	251 40.7	+20 54.9	254 24.6	+19 10.3	108 57.3	− 6 12.9	39 33.1	64	−26 23.3	+ 28
7	325 53.1	313 05.8	19.4	266 41.4	55.3	269 26.5	10.5	124 00.0	12.9	53 58.5	63	26 20.5	+ 29
8	340 55.5	328 08.2	18.8	281 42.0	55.7	284 28.3	10.6	139 02.6	12.8	68 23.8	65	26 17.6	+ 30
9	355 58.0	343 10.5	•• 18.2	296 42.7	•• 56.1	299 30.2	•• 10.7	154 05.2	•• 12.7	82 49.3	64	•26 14.6	+ 33
10	11 00.5	358 12.9	17.7	311 43.3	56.4	314 32.1	10.9	169 07.9	12.7	97 14.7	64	26 11.3	+ 33
11	26 02.9	13 15.2	17.1	326 44.0	56.8	329 33.9	11.0	184 10.5	12.6	111 40.1	64	26 08.0	+ 36
12	41 05.4	28 17.6	+ 8 16.5	341 44.6	+20 57.2	344 35.8	+19 11.1	199 13.1	− 6 12.6	126 05.5	65	−26 04.4	+ 37
13	56 07.9	43 19.9	16.0	356 45.2	57.6	359 37.7	11.2	214 15.7	12.5	140 31.0	65	26 00.7	+ 39
14	71 10.3	58 22.2	15.4	11 45.9	57.9	14 39.5	11.4	229 18.4	12.4	154 56.5	64	25 56.8	+ 40
15	86 12.8	73 24.6	•• 14.9	26 46.5	•• 58.3	29 41.4	•• 11.5	244 21.0	•• 12.4	169 21.9	65	•25 52.8	+ 42
16	101 15.3	88 26.9	14.3	41 47.2	58.7	44 43.3	11.6	259 23.6	12.3	183 47.4	66	25 48.6	+ 43
17	116 17.7	103 29.2	13.8	56 47.8	59.1	59 45.1	11.8	274 26.3	12.3	198 13.0	65	25 44.3	+ 45
18	131 20.2	118 31.5	+ 8 13.2	71 48.5	+20 59.4	74 47.0	+19 11.9	289 28.9	− 6 12.2	212 38.5	66	−25 39.8	+ 47
19	146 22.6	133 33.8	12.7	86 49.1	20 59.8	89 48.9	12.0	304 31.5	12.1	227 04.1	66	25 35.1	+ 48
20	161 25.1	148 36.1	12.1	101 49.7	21 00.2	104 50.8	12.2	319 34.1	12.1	241 29.7	66	25 30.3	+ 50
21	176 27.6	163 38.4	•• 11.6	116 50.4	•• 00.5	119 52.6	•• 12.3	334 36.8	•• 12.0	255 55.3	66	•25 25.3	+ 51
22	191 30.0	178 40.8	11.0	131 51.0	00.9	134 54.5	12.4	349 39.4	12.0	270 20.9	67	25 20.2	+ 53
23	206 32.5	193 43.0	10.5	146 51.7	01.3	149 56.4	12.6	4 42.0	11.9	284 46.6	67	25 14.9	+ 55
24	221 35.0	208 45.3	+ 8 10.0	161 52.3	+21 01.7	164 58.2	+19 12.7	19 44.6	− 6 11.8	299 12.3	67	−25 09.4	+ 56
code	−	+ 24	− 6	+ 6	+ 4	+ 19	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
1 0	180 43.3	+14 55.2
1	195 43.4	55.9
2	210 43.5	56.7
3	225 43.6	57.5
4	240 43.6	58.2
5	255 43.7	59.0
6	270 43.8	+14 59.7
7	285 43.9	15 00.5
8	300 44.0	01.3
9	315 44.0	02.0
10	330 44.1	02.8
11	345 44.2	03.5
12	0 44.3	+15 04.3
13	15 44.4	05.0
14	30 44.4	05.8
15	45 44.5	06.5
16	60 44.6	07.3
17	75 44.7	08.1
18	90 44.7	+15 08.8
19	105 44.8	09.6
20	120 44.9	10.3
21	135 45.0	11.1
22	150 45.1	11.8
23	165 45.1	12.6
2 0	180 45.2	+15 13.3
1	195 45.3	14.1
2	210 45.3	14.8
3	225 45.4	15.6
4	240 45.5	16.3
5	255 45.6	17.1
6	270 45.6	+15 17.8
7	285 45.7	18.6
8	300 45.8	19.3
9	315 45.9	20.1
10	330 45.9	20.8
11	345 46.0	21.6
12	0 46.1	+15 22.3
13	15 46.2	23.1
14	30 46.2	23.8
15	45 46.3	24.5
16	60 46.4	25.3
17	75 46.4	26.0
18	90 46.5	+15 26.8
19	105 46.6	27.5
20	120 46.7	28.3
21	135 46.7	29.0
22	150 46.8	29.7
23	165 46.9	30.5
3 0	180 46.9	+15 31.2
1	195 47.0	32.0
2	210 47.1	32.7
3	225 47.1	33.4
4	240 47.2	34.2
5	255 47.3	34.9
6	270 47.3	+15 35.7
7	285 47.4	36.4
8	300 47.5	37.1
9	315 47.5	37.9
10	330 47.6	38.6
11	345 47.7	39.4
12	0 47.7	+15 40.1
13	15 47.8	40.8
14	30 47.9	41.6
15	45 47.9	42.3
16	60 48.0	43.0
17	75 48.1	43.8
18	90 48.1	+15 44.5
19	105 48.2	45.2
20	120 48.3	46.0
21	135 48.3	46.7
22	150 48.4	47.4
23	165 48.5	48.1
24	180 48.5	+15 48.9
code	—	+ 8

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.2
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.8
34	Alkaid	153 33.7	+49 32.6
55	Al Na'ir	28 40.3	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.6	+28 49.9
51	Altair	62 52.1	+ 8 44.4
2	Ankaa	354 00.4	−42 33.4
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.3	−68 56.7
22	Avior	234 36.8	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.5	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.3	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.4	−18 14.5
27	Dubhe	194 46.3	+62 00.3
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.7	+51 29.3
54	Enif	34 31.5	+ 9 39.5
56	Fomalhaut	16 13.8	−29 52.1
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 16.3	+74 20.6
57	Markab	14 23.5	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.5	−36 08.7
24	Miapl'dus	221 49.6	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.0	−26 21.4
52	Peacock	54 30.0	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.1	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.0	−60 38.9
44	Sabik	103 04.0	−15 40.3
3	Schedar	350 32.8	+56 16.8
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.8	−43 14.9
49	Vega	81 09.3	+38 44.0
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 1	2	3
h	m s	m s	m s
0	+ 2 53.2	+ 3 00.7	+ 3 07.6
6	+ 2 55.1	+ 3 02.4	+ 3 09.2
12	+ 2 57.0	+ 3 04.2	+ 3 10.9
18	+ 2 58.8	+ 3 05.9	+ 3 12.4
24	+ 3 00.7	+ 3 07.6	+ 3 14.0

Lat.	Sunrise	Twlt. begins	Moonrise 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	1 46	////	■	■	■	■
70	2 27	////	■	■	■	■
68	2 54	////	■	■	■	■
66	3 15	////	■	■	■	■
64	3 31	////	0 16	■	■	3 02
62	3 45	////	24 59	0 59	1 56	2 15
60	3 56	////	24 15	0 15	1 13	1 45
58	4 06	////	23 46	24 44	0 44	1 21
56	4 14	0 48	23 24	24 22	0 22	1 03
54	4 22	1 31	23 05	24 04	0 04	0 47
52	4 29	1 57	22 50	23 48	24 33	0 33
50	4 35	2 17	22 36	23 35	24 21	0 21
45	4 48	2 52	22 09	23 07	23 56	24 36
40	4 59	3 16	21 47	22 46	23 36	24 19
35	5 09	3 36	21 29	22 27	23 19	24 05
30	5 17	3 50	21 14	22 12	23 05	23 52
20	5 30	4 13	20 48	21 46	22 40	23 31
10	5 42	4 30	20 25	21 23	22 19	23 13
0	5 54	4 43	20 05	21 02	21 59	22 55
10	6 05	4 52	19 44	20 41	21 39	22 38
20	6 16	5 01	19 22	20 18	21 18	22 20
30	6 29	5 08	18 56	19 52	20 53	21 58
35	6 37	5 10	18 41	19 36	20 38	21 45
40	6 45	5 13	18 23	19 18	20 21	21 31
45	6 56	5 14	18 02	18 57	20 01	21 13
50	7 08	5 16	17 36	18 29	19 35	20 52
52	7 13	5 17	17 23	18 16	19 23	20 42
54	7 19	5 17	17 08	18 00	19 09	20 30
56	7 26	5 17	16 51	17 42	18 52	20 16
58	7 34	5 17	16 30	17 20	18 32	20 01
60	7 43	5 17	16 04	16 51	18 07	19 42
S						

Lat.	Sunset	Twlt. ends	Moonset 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	22 16	////	■	■	■	■
70	21 32	////	■	■	■	■
68	21 04	////	■	■	■	■
66	20 42	////	■	■	■	■
64	20 25	////	2 22	■	■	5 33
62	20 12	////	3 14	3 36	4 38	6 19
60	20 00	////	3 46	4 19	5 21	6 49
58	19 50	////	4 10	4 48	5 49	7 11
56	19 41	23 18	4 30	5 11	6 11	7 30
54	19 33	22 30	4 46	5 29	6 29	7 45
52	19 26	22 02	5 00	5 45	6 45	7 59
50	19 20	21 41	5 12	5 58	6 58	8 10
45	19 06	21 05	5 37	6 26	7 26	8 35
40	18 55	20 39	5 58	6 48	7 47	8 54
35	18 46	20 20	6 15	7 06	8 05	9 10
30	18 38	20 05	6 29	7 22	8 20	9 24
20	18 24	19 42	6 54	7 48	8 46	9 47
10	18 12	19 25	7 16	8 11	9 09	10 07
0	18 00	19 11	7 36	8 32	9 29	10 26
10	17 49	19 01	7 56	8 53	9 50	10 45
20	17 38	18 53	8 18	9 16	10 12	11 05
30	17 24	18 45	8 43	9 42	10 38	11 28
35	17 17	18 43	8 57	9 58	10 53	11 41
40	17 08	18 40	9 15	10 16	11 10	11 57
45	16 58	18 38	9 35	10 37	11 31	12 15
50	16 46	18 36	10 01	11 05	11 57	12 38
52	16 40	18 35	10 14	11 18	12 10	12 48
54	16 34	18 35	10 28	11 34	12 24	13 00
56	16 27	18 35	10 45	11 52	12 41	13 14
58	16 19	18 34	11 06	12 14	13 01	13 31
60	16 10	18 34	11 32	12 43	13 27	13 50
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
1	1 23	10 15	13 15	13 08	22 50
2	2 18	10 11	13 14	13 05	22 46
3	3 16	10 07	13 13	13 02	22 41
4	4 13	10 03	13 12	12 59	22 37

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0			
30	0.2	0.4	0.1
45	0.2	0.3	0.0
60	0.2	0.3	0.0
75	0.2	0.2	0.0
90	0.2	0.1	0.0

Moon's Lower Limb
Add

Alt.	1	2	3
°	′	′	′
0	14.9	15.6	16.2
4	14.9	15.6	16.2
8	14.9	15.6	16.2
12	14.9	15.6	16.2
16	14.9	15.6	16.2
20	15.0	15.6	16.2
24	15.0	15.6	16.1
28	15.0	15.6	16.1
32	15.0	15.6	16.1
36	15.0	15.6	16.1
40	15.0	15.6	16.1
44	15.1	15.6	16.0
48	15.1	15.6	16.0
52	15.1	15.6	16.0
56	15.1	15.6	16.0
60	15.2	15.6	15.9
64	15.2	15.6	15.9
68	15.2	15.6	15.9
72	15.3	15.6	15.8
76	15.3	15.6	15.8
80	15.3	15.6	15.8
84	15.4	15.6	15.7
88	15.4	15.6	15.7
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	1	2	3
°	′	′	′
0	15.9	15.6	15.2
4	15.9	15.6	15.2
8	15.9	15.6	15.2
12	15.9	15.6	15.2
16	15.9	15.6	15.2
20	15.9	15.6	15.2
24	15.9	15.6	15.2
28	15.8	15.6	15.3
32	15.8	15.6	15.3
36	15.8	15.6	15.3
40	15.8	15.6	15.3
44	15.8	15.6	15.3
48	15.7	15.6	15.4
52	15.7	15.6	15.4
56	15.7	15.6	15.4
60	15.6	15.6	15.5
64	15.6	15.6	15.5
68	15.6	15.6	15.5
72	15.6	15.6	15.5
76	15.5	15.6	15.6
80	15.5	15.6	15.6
84	15.4	15.6	15.7
88	15.4	15.6	15.7
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
4 0	221 35.0	208 45.3	+ 8 10.0	161 52.3	+21 01.7	164 58.2	+19 12.7	19 44.6	− 6 11.8	299 12.3	67	−25 09.4	+ 56
1	236 37.4	223 47.6	09.4	176 52.9	02.0	180 00.1	12.8	34 47.3	11.8	313 38.0	68	25 03.8	+ 57
2	251 39.9	238 49.9	08.9	191 53.6	02.4	195 02.0	13.0	49 49.9	11.7	328 03.8	68	24 58.1	+ 59
3	266 42.4	253 52.2	•• 08.4	206 54.2	•• 02.8	210 03.8	•• 13.1	64 52.5	•• 11.7	342 29.6	68	•24 52.2	+ 61
4	281 44.8	268 54.5	07.8	221 54.9	03.1	225 05.7	13.2	79 55.2	11.6	356 55.4	69	24 46.1	+ 62
5	296 47.3	283 56.8	07.3	236 55.5	03.5	240 07.6	13.3	94 57.8	11.5	11 21.3	69	24 39.9	+ 64
6	311 49.8	298 59.0	+ 8 06.8	251 56.2	+21 03.9	255 09.4	+19 13.5	110 00.4	− 6 11.5	25 47.2	70	−24 33.5	+ 65
7	326 52.2	314 01.3	06.2	266 56.8	04.3	270 11.3	13.6	125 03.0	11.4	40 13.2	70	24 27.0	+ 67
8	341 54.7	329 03.6	05.7	281 57.4	04.6	285 13.2	13.7	140 05.7	11.4	54 39.2	70	24 20.3	+ 68
9	356 57.1	344 05.8	•• 05.2	296 58.1	•• 05.0	300 15.0	•• 13.9	155 08.3	•• 11.3	69 05.2	71	•24 13.5	+ 69
10	11 59.6	359 08.1	04.7	311 58.7	05.4	315 16.9	14.0	170 10.9	11.2	83 31.3	71	24 06.6	+ 72
11	27 02.1	14 10.3	04.2	326 59.4	05.7	330 18.8	14.1	185 13.5	11.2	97 57.4	71	23 59.4	+ 72
12	42 04.5	29 12.6	+ 8 03.7	342 00.0	+21 06.1	345 20.6	+19 14.3	200 16.2	− 6 11.1	112 23.5	72	−23 52.2	+ 74
13	57 07.0	44 14.8	03.1	357 00.6	06.5	0 22.5	14.4	215 18.8	11.1	126 49.7	73	23 44.8	+ 76
14	72 09.5	59 17.1	02.6	12 01.3	06.8	15 24.4	14.5	230 21.4	11.0	141 16.0	73	23 37.2	+ 77
15	87 11.9	74 19.3	•• 02.1	27 01.9	•• 07.2	30 26.2	•• 14.7	245 24.0	•• 10.9	155 42.3	73	•23 29.5	+ 78
16	102 14.4	89 21.6	01.6	42 02.6	07.6	45 28.1	14.8	260 26.7	10.9	170 08.6	74	23 21.7	+ 80
17	117 16.9	104 23.8	01.1	57 03.2	07.9	60 30.0	14.9	275 29.3	10.8	184 35.0	74	23 13.7	+ 82
18	132 19.3	119 26.0	+ 8 00.6	72 03.8	+21 08.3	75 31.8	+19 15.0	290 31.9	− 6 10.8	199 01.4	75	−23 05.5	+ 82
19	147 21.8	134 28.2	8 00.1	87 04.5	08.7	90 33.7	15.2	305 34.6	10.7	213 27.9	76	22 57.3	+ 84
20	162 24.3	149 30.5	7 59.6	102 05.1	09.0	105 35.6	15.3	320 37.2	10.6	227 54.5	76	22 48.9	+ 86
21	177 26.7	164 32.7	•• 59.1	117 05.8	•• 09.4	120 37.4	•• 15.4	335 39.8	•• 10.6	242 21.1	76	•22 40.3	+ 87
22	192 29.2	179 34.9	58.6	132 06.4	09.8	135 39.3	15.6	350 42.4	10.5	256 47.7	77	22 31.6	+ 88
23	207 31.6	194 37.1	58.1	147 07.0	10.1	150 41.2	15.7	5 45.1	10.5	271 14.4	77	22 22.8	+ 90
5 0	222 34.1	209 39.3	+ 7 57.6	162 07.7	+21 10.5	165 43.0	+19 15.8	20 47.7	− 6 10.4	285 41.1	78	−22 13.8	+ 91
1	237 36.6	224 41.5	57.1	177 08.3	10.8	180 44.9	16.0	35 50.3	10.4	300 07.9	79	22 04.7	+ 92
2	252 39.0	239 43.7	56.7	192 09.0	11.2	195 46.8	16.1	50 52.9	10.3	314 34.8	79	21 55.5	+ 94
3	267 41.5	254 45.9	•• 56.2	207 09.6	•• 11.6	210 48.6	•• 16.2	65 55.6	•• 10.2	329 01.7	79	•21 46.1	+ 95
4	282 44.0	269 48.1	55.7	222 10.2	11.9	225 50.5	16.3	80 58.2	10.2	343 28.6	81	21 36.6	+ 96
5	297 46.4	284 50.3	55.2	237 10.9	12.3	240 52.4	16.5	96 00.8	10.1	357 55.7	80	21 27.0	+ 98
6	312 48.9	299 52.5	+ 7 54.7	252 11.5	+21 12.7	255 54.2	+19 16.6	111 03.4	− 6 10.1	12 22.7	82	−21 17.2	+ 99
7	327 51.4	314 54.6	54.3	267 12.2	13.0	270 56.1	16.7	126 06.1	10.0	26 49.9	81	21 07.3	+100
8	342 53.8	329 56.8	53.8	282 12.8	13.4	285 58.0	16.9	141 08.7	09.9	41 17.0	83	20 57.3	+102
9	357 56.3	344 59.0	•• 53.3	297 13.4	•• 13.7	300 59.8	•• 17.0	156 11.3	•• 09.9	55 44.3	83	•20 47.1	+102
10	12 58.7	0 01.2	52.8	312 14.1	14.1	316 01.7	17.1	171 13.9	09.8	70 11.6	83	20 36.9	+104
11	28 01.2	15 03.3	52.4	327 14.7	14.5	331 03.6	17.3	186 16.6	09.8	84 38.9	84	20 26.5	+106
12	43 03.7	30 05.5	+ 7 51.9	342 15.3	+21 14.8	346 05.4	+19 17.4	201 19.2	− 6 09.7	99 06.3	85	−20 15.9	+106
13	58 06.1	45 07.7	51.4	357 16.0	15.2	1 07.3	17.5	216 21.8	09.7	113 33.8	85	20 05.3	+108
14	73 08.6	60 09.8	51.0	12 16.6	15.5	16 09.2	17.6	231 24.4	09.6	128 01.3	86	19 54.5	+109
15	88 11.1	75 12.0	•• 50.5	27 17.3	•• 15.9	31 11.0	•• 17.8	246 27.1	•• 09.5	142 28.9	86	•19 43.6	+110
16	103 13.5	90 14.1	50.0	42 17.9	16.3	46 12.9	17.9	261 29.7	09.5	156 56.5	87	19 32.6	+111
17	118 16.0	105 16.3	49.6	57 18.5	16.6	61 14.8	18.0	276 32.3	09.4	171 24.2	88	19 21.5	+113
18	133 18.5	120 18.4	+ 7 49.1	72 19.2	+21 17.0	76 16.6	+19 18.2	291 34.9	− 6 09.4	185 52.0	88	−19 10.2	+113
19	148 20.9	135 20.5	48.7	87 19.8	17.3	91 18.5	18.3	306 37.6	09.3	200 19.8	89	18 58.9	+115
20	163 23.4	150 22.7	48.2	102 20.5	17.7	106 20.4	18.4	321 40.2	09.2	214 47.7	89	18 47.4	+116
21	178 25.9	165 24.8	•• 47.8	117 21.1	•• 18.0	121 22.2	•• 18.6	336 42.8	•• 09.2	229 15.6	90	•18 35.8	+117
22	193 28.3	180 26.9	47.3	132 21.7	18.4	136 24.1	18.7	351 45.4	09.1	243 43.6	90	18 24.1	+118
23	208 30.8	195 29.1	46.9	147 22.4	18.8	151 26.0	18.8	6 48.0	09.1	258 11.6	91	18 12.3	+120
6 0	223 33.2	210 31.2	+ 7 46.4	162 23.0	+21 19.1	166 27.8	+19 18.9	21 50.7	− 6 09.0	272 39.7	91	−18 00.3	+120
1	238 35.7	225 33.3	46.0	177 23.6	19.5	181 29.7	19.1	36 53.3	09.0	287 07.8	92	17 48.3	+121
2	253 38.2	240 35.4	45.6	192 24.3	19.8	196 31.6	19.2	51 55.9	08.9	301 36.0	93	17 36.2	+123
3	268 40.6	255 37.5	•• 45.1	207 24.9	•• 20.2	211 33.4	•• 19.3	66 58.5	•• 08.8	316 04.3	93	•17 23.9	+123
4	283 43.1	270 39.6	44.7	222 25.6	20.5	226 35.3	19.5	82 01.2	08.8	330 32.6	94	17 11.6	+125
5	298 45.6	285 41.7	44.3	237 26.2	20.9	241 37.1	19.6	97 03.8	08.7	345 01.0	94	16 59.1	+125
6	313 48.0	300 43.8	+ 7 43.8	252 26.8	+21 21.2	256 39.0	+19 19.7	112 06.4	− 6 08.7	359 29.4	94	−16 46.6	+127
7	328 50.5	315 45.9	43.4	267 27.5	21.6	271 40.9	19.9	127 09.0	08.6	13 57.8	96	16 33.9	+128
8	343 53.0	330 48.0	43.0	282 28.1	21.9	286 42.7	20.0	142 11.7	08.5	28 26.4	95	16 21.1	+128
9	358 55.4	345 50.1	•• 42.5	297 28.7	•• 22.3	301 44.6	•• 20.1	157 14.3	•• 08.5	42 54.9	97	•16 08.3	+130
10	13 57.9	0 52.2	42.1	312 29.4	22.6	316 46.5	20.2	172 16.9	08.4	57 23.6	97	15 55.3	+130
11	29 00.4	15 54.3	41.7	327 30.0	23.0	331 48.3	20.4	187 19.5	08.4	71 52.3	97	15 42.3	+132
12	44 02.8	30 56.4	+ 7 41.3	342 30.7	+21 23.4	346 50.2	+19 20.5	202 22.2	− 6 08.3	86 21.0	98	−15 29.1	+132
13	59 05.3	45 58.4	40.9	357 31.3	23.7	1 52.1	20.6	217 24.8	08.3	100 49.8	98	15 15.9	+133
14	74 07.7	61 00.5	40.4	12 31.9	24.1	16 53.9	20.8	232 27.4	08.2	115 18.6	99	15 02.6	+135
15	89 10.2	76 02.6	•• 40.0	27 32.6	•• 24.4	31 55.8	•• 20.9	247 30.0	•• 08.1	129 47.5	99	•14 49.1	+135
16	104 12.7	91 04.6	39.6	42 33.2	24.8	46 57.7	21.0	262 32.6	08.1	144 16.4	100	14 35.6	+136
17	119 15.1	106 06.7	39.2	57 33.8	25.1	61 59.5	21.1	277 35.3	08.0	158 45.4	100	14 22.0	+137
18	134 17.6	121 08.7	+ 7 38.8	72 34.5	+21 25.5	77 01.4	+19 21.3	292 37.9	− 6 08.0	173 14.4	101	−14 08.3	+137
19	149 20.1	136 10.8	38.4	87 35.1	25.8	92 03.3	21.4	307 40.5	07.9	187 43.5	101	13 54.6	+139
20	164 22.5	151 12.9	38.0	102 35.8	26.2	107 05.1	21.5	322 43.1	07.9	202 12.6	102	13 40.7	+139
21	179 25.0	166 14.9	•• 37.6	117 36.4	•• 26.5	122 07.0	•• 21.7	337 45.8	•• 07.8	216 41.8	102	•13 26.8	+140
22	194 27.5	181 16.9	37.2	132 37.0	26.8	137 08.8	21.8	352 48.4	07.7	231 11.0	102	13 12.8	+141
23	209 29.9	196 19.0	36.8	147 37.7	27.2	152 10.7	21.9	7 51.0	07.7	245 40.2	103	12 58.7	+142
24	224 32.4	211 21.0	+ 7 36.4	162 38.3	+21 27.5	167 12.6	+19 22.1	22 53.6	− 6 07.6	260 09.5	104	−12 44.5	+143
code	−	+ 22	− 5	+ 7	+ 4	+ 19	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
4 0	180 48.5	+15 48.9
1	195 48.6	49.6
2	210 48.7	50.3
3	225 48.7 ••	51.1
4	240 48.8	51.8
5	255 48.8	52.5
6	270 48.9	+15 53.3
7	285 49.0	54.0
8	300 49.0	54.7
9	315 49.1 ••	55.4
10	330 49.1	56.2
11	345 49.2	56.9
12	0 49.3	+15 57.6
13	15 49.3	58.3
14	30 49.4	59.1
15	45 49.4	+15 59.8
16	60 49.5	16 00.5
17	75 49.6	01.2
18	90 49.6	+16 01.9
19	105 49.7	02.7
20	120 49.7	03.4
21	135 49.8 ••	04.1
22	150 49.9	04.8
23	165 49.9	05.5
5 0	180 50.0	+16 06.3
1	195 50.0	07.0
2	210 50.1	07.7
3	225 50.1 ••	08.4
4	240 50.2	09.1
5	255 50.3	09.9
6	270 50.3	+16 10.6
7	285 50.4	11.3
8	300 50.4	12.0
9	315 50.5 ••	12.7
10	330 50.5	13.4
11	345 50.6	14.1
12	0 50.6	+16 14.9
13	15 50.7	15.6
14	30 50.8	16.3
15	45 50.8 ••	17.0
16	60 50.9	17.7
17	75 50.9	18.4
18	90 51.0	+16 19.1
19	105 51.0	19.8
20	120 51.1	20.6
21	135 51.1 ••	21.3
22	150 51.2	22.0
23	165 51.2	22.7
6 0	180 51.3	+16 23.4
1	195 51.3	24.1
2	210 51.4	24.8
3	225 51.4 ••	25.5
4	240 51.5	26.2
5	255 51.5	26.9
6	270 51.6	+16 27.6
7	285 51.6	28.3
8	300 51.7	29.0
9	315 51.7 ••	29.7
10	330 51.8	30.4
11	345 51.8	31.1
12	0 51.9	+16 31.9
13	15 51.9	32.6
14	30 52.0	33.3
15	45 52.0 ••	34.0
16	60 52.1	34.7
17	75 52.1	35.4
18	90 52.2	+16 36.1
19	105 52.2	36.8
20	120 52.3	37.5
21	135 52.3 ••	38.1
22	150 52.4	38.8
23	165 52.4	39.5
24	180 52.4	+16 40.2
code	−	+ 7

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.2
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.8
34	Alkaid	153 33.7	+49 32.7
55	Al Na'ir	28 40.3	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.6	+28 49.9
51	Altair	62 52.1	+ 8 44.4
2	Ankaa	354 00.3	−42 33.4
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.3	−68 56.7
22	Avior	234 36.8	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.6	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.3	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.3	−18 14.5
27	Dubhe	194 46.3	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.7	+51 29.3
54	Enif	34 31.5	+ 9 39.5
56	Fomalhaut	16 13.8	−29 52.1
31	Gacrux	172 51.0	−56 51.4
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 16.3	+74 20.7
57	Markab	14 23.5	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.5	−36 08.7
24	Miapl'dus	221 49.7	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 54.0	−26 21.4
52	Peacock	54 30.0	−56 53.0
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.7
46	R'alhague	96 48.1	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.0	−60 38.9
44	Sabik	103 04.0	−15 40.3
3	Schedar	350 32.7	+56 16.8
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.8	−43 14.9
49	Vega	81 09.3	+38 44.0
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 4	5	6
h	m s	m s	m s
0	+ 3 14.0	+ 3 19.8	+ 3 25.0
6	+ 3 15.5	+ 3 21.2	+ 3 26.2
12	+ 3 17.0	+ 3 22.5	+ 3 27.4
18	+ 3 18.4	+ 3 23.8	+ 3 28.6
24	+ 3 19.8	+ 3 25.0	+ 3 29.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 4 h m	5 h m	6 h m	7 h m
72	1 16	////	■	■	4 47	3 31
70	2 08	////	■	■	3 54	3 11
68	2 40	////	■	4 25	3 21	2 55
66	3 03	////	■	3 22	2 57	2 42
64	3 21	////	3 02	2 46	2 38	2 31
62	3 36	////	2 15	2 21	2 22	2 21
60	3 48	////	1 45	2 00	2 08	2 13
58	3 59	////	1 21	1 43	1 57	2 06
56	4 08	////	1 03	1 29	1 47	2 00
54	4 16	1 14	0 47	1 17	1 38	1 54
52	4 23	1 45	0 33	1 06	1 30	1 49
50	4 30	2 08	0 21	0 56	1 23	1 44
45	4 44	2 45	24 36	0 36	1 08	1 34
40	4 56	3 12	24 19	0 19	0 55	1 26
35	5 05	3 31	24 05	0 05	0 44	1 18
30	5 14	3 47	23 52	24 34	0 34	1 12
20	5 29	4 11	23 31	24 18	0 18	1 01
10	5 41	4 28	23 13	24 03	0 03	0 51
0	5 53	4 41	22 55	23 50	24 41	0 41
10	6 05	4 53	22 38	23 36	24 32	0 32
20	6 17	5 02	22 20	23 21	24 22	0 22
30	6 31	5 09	21 58	23 04	24 11	0 11
35	6 39	5 13	21 45	22 54	24 04	0 04
40	6 49	5 16	21 31	22 43	23 56	25 09
45	6 59	5 18	21 13	22 30	23 47	25 05
50	7 12	5 20	20 52	22 13	23 37	25 00
52	7 18	5 21	20 42	22 06	23 32	24 57
54	7 25	5 21	20 30	21 57	23 26	24 55
56	7 32	5 22	20 16	21 47	23 20	24 52
58	7 41	5 22	20 01	21 36	23 13	24 48
60	7 50	5 23	19 42	21 23	23 05	24 45
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 4 h m	5 h m	6 h m	7 h m
72	22 48	////	■	■	7 41	10 46
70	21 51	////	■	■	8 32	11 03
68	21 17	////	■	6 06	9 03	11 17
66	20 54	////	■	7 10	9 26	11 28
64	20 35	////	5 33	7 44	9 44	11 38
62	20 20	////	6 19	8 09	9 59	11 45
60	20 07	////	6 49	8 29	10 11	11 52
58	19 56	////	7 11	8 45	10 22	11 58
56	19 47	////	7 30	8 59	10 31	12 03
54	19 39	22 47	7 45	9 10	10 39	12 08
52	19 31	22 13	7 59	9 21	10 46	12 12
50	19 24	21 50	8 10	9 30	10 53	12 16
45	19 10	21 11	8 35	9 49	11 07	12 24
40	18 58	20 44	8 54	10 05	11 18	12 31
35	18 48	20 23	9 10	10 18	11 28	12 37
30	18 40	20 08	9 24	10 30	11 36	12 42
20	18 25	19 44	9 47	10 49	11 50	12 51
10	18 12	19 26	10 07	11 06	12 03	12 58
0	18 00	19 12	10 26	11 22	12 15	13 05
10	17 48	19 00	10 45	11 37	12 26	13 12
20	17 36	18 51	11 05	11 54	12 38	13 20
30	17 22	18 44	11 28	12 12	12 52	13 28
35	17 14	18 40	11 41	12 23	13 00	13 33
40	17 04	18 36	11 57	12 36	13 09	13 38
45	16 54	18 34	12 15	12 50	13 19	13 44
50	16 41	18 32	12 38	13 08	13 32	13 52
52	16 35	18 31	12 48	13 17	13 38	13 55
54	16 28	18 30	13 00	13 26	13 44	13 59
56	16 20	18 29	13 14	13 36	13 51	14 03
58	16 12	18 28	13 31	13 48	13 59	14 07
60	16 03	18 28	13 50	14 02	14 08	14 12
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
4	4 13	10 03	13 12	12 59	22 37
5	5 09	10 00	13 11	12 56	22 33
6	6 02	9 57	13 10	12 53	22 29
7	6 53	9 53	13 09	12 50	22 25

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0			
30	0.2	0.4	0.1
45	0.2	0.3	0.0
60	0.2	0.3	0.0
75	0.2	0.2	0.0
90	0.2	0.1	0.0

Moon's Lower Limb Add

Alt. °	4 ′	5 ′	6 ′
0	16.8	17.5	18.1
4	16.8	17.5	18.1
8	16.8	17.4	18.1
12	16.8	17.4	18.0
16	16.8	17.4	18.0
20	16.8	17.4	18.0
24	16.7	17.3	17.9
28	16.7	17.3	17.8
32	16.7	17.2	17.8
36	16.6	17.1	17.7
40	16.6	17.1	17.6
44	16.5	17.0	17.5
48	16.5	16.9	17.4
52	16.4	16.8	17.3
56	16.4	16.8	17.2
60	16.3	16.7	17.0
64	16.2	16.6	16.9
68	16.2	16.5	16.8
72	16.1	16.4	16.6
76	16.0	16.3	16.5
80	16.0	16.2	16.4
84	15.9	16.1	16.2
88	15.8	16.0	16.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	4 ′	5 ′	6 ′
0	14.8	14.5	14.1
4	14.8	14.5	14.1
8	14.8	14.5	14.1
12	14.9	14.5	14.2
16	14.9	14.5	14.2
20	14.9	14.6	14.2
24	14.9	14.6	14.3
28	15.0	14.7	14.4
32	15.0	14.7	14.4
36	15.0	14.8	14.5
40	15.1	14.8	14.6
44	15.1	14.9	14.7
48	15.2	15.0	14.8
52	15.2	15.1	14.9
56	15.3	15.2	15.0
60	15.4	15.3	15.2
64	15.4	15.3	15.3
68	15.5	15.4	15.4
72	15.5	15.5	15.5
76	15.6	15.6	15.7
80	15.7	15.8	15.8
84	15.8	15.9	16.0
88	15.8	15.9	16.1
90			

Subtract from table, back cover

Last Quarter 6

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
7 h 0	224 32.4	211 21.0	+ 7 36.4	162 38.3	+21 27.5	167 12.6	+19 22.1	22 53.6	− 6 07.6	260 09.5	104	−12 44.5	+143
1	239 34.9	226 23.0	36.0	177 38.9	27.9	182 14.4	22.2	37 56.2	07.6	274 38.9	104	12 30.2	+143
2	254 37.3	241 25.1	35.6	192 39.6	28.2	197 16.3	22.3	52 58.9	07.5	289 08.3	104	12 15.9	+144
3	269 39.8	256 27.1	•• 35.2	207 40.2	•• 28.6	212 18.2	•• 22.4	68 01.5	•• 07.5	303 37.7	104	·12 01.5	+145
4	284 42.2	271 29.1	34.8	222 40.8	28.9	227 20.0	22.6	83 04.1	07.4	318 07.1	105	11 47.0	+145
5	299 44.7	286 31.1	34.4	237 41.5	29.3	242 21.9	22.7	98 06.7	07.3	332 36.6	106	11 32.5	+147
6	314 47.2	301 33.2	+ 7 34.1	252 42.1	+21 29.6	257 23.8	+19 22.8	113 09.3	− 6 07.3	347 06.2	105	−11 17.8	+146
7	329 49.6	316 35.2	33.7	267 42.8	30.0	272 25.6	23.0	128 12.0	07.2	1 35.7	106	11 03.2	+148
8	344 52.1	331 37.2	33.3	282 43.4	30.3	287 27.5	23.1	143 14.6	07.2	16 05.3	107	10 48.4	+148
9	359 54.6	346 39.2	•• 32.9	297 44.0	•• 30.7	302 29.3	•• 23.2	158 17.2	•• 07.1	30 35.0	107	·10 33.6	+149
10	14 57.0	1 41.2	32.5	312 44.7	31.0	317 31.2	23.3	173 19.8	07.1	45 04.7	107	10 18.7	+150
11	29 59.5	16 43.2	32.2	327 45.3	31.3	332 33.1	23.5	188 22.5	07.0	59 34.4	107	10 03.7	+150
12	45 02.0	31 45.2	+ 7 31.8	342 45.9	+21 31.7	347 34.9	+19 23.6	203 25.1	− 6 07.0	74 04.1	108	− 9 48.7	+151
13	60 04.4	46 47.2	31.4	357 46.6	32.0	2 36.8	23.7	218 27.7	06.9	88 33.9	108	9 33.6	+151
14	75 06.9	61 49.2	31.1	12 47.2	32.4	17 38.7	23.9	233 30.3	06.8	103 03.7	108	9 18.5	+152
15	90 09.3	76 51.2	•• 30.7	27 47.8	•• 32.7	32 40.5	•• 24.0	248 32.9	•• 06.8	117 33.5	109	• 9 03.3	+152
16	105 11.8	91 53.1	30.3	42 48.5	33.1	47 42.4	24.1	263 35.6	06.7	132 03.4	109	8 48.1	+153
17	120 14.3	106 55.1	30.0	57 49.1	33.4	62 44.3	24.2	278 38.2	06.7	146 33.3	109	8 32.8	+154
18	135 16.7	121 57.1	+ 7 29.6	72 49.7	+21 33.7	77 46.1	+19 24.4	293 40.8	− 6 06.6	161 03.2	109	− 8 17.4	+154
19	150 19.2	136 59.1	29.2	87 50.4	34.1	92 48.0	24.5	308 43.4	06.6	175 33.1	110	8 02.0	+154
20	165 21.7	152 01.0	28.9	102 51.0	34.4	107 49.8	24.6	323 46.0	06.5	190 03.1	110	7 46.6	+156
21	180 24.1	167 03.0	•• 28.5	117 51.6	•• 34.8	122 51.7	•• 24.8	338 48.7	•• 06.4	204 33.1	110	• 7 31.0	+155
22	195 26.6	182 05.0	28.2	132 52.3	35.1	137 53.6	24.9	353 51.3	06.4	219 03.1	110	7 15.5	+156
23	210 29.1	197 06.9	27.8	147 52.9	35.4	152 55.4	25.0	8 53.9	06.3	233 33.1	111	6 59.9	+157
8 0	225 31.5	212 08.9	+ 7 27.5	162 53.6	+21 35.8	167 57.3	+19 25.1	23 56.5	− 6 06.3	248 03.2	110	− 6 44.2	+156
1	240 34.0	227 10.8	27.1	177 54.2	36.1	182 59.2	25.3	38 59.1	06.2	262 33.2	111	6 28.6	+158
2	255 36.5	242 12.8	26.8	192 54.8	36.4	198 01.0	25.4	54 01.8	06.2	277 03.3	111	6 12.8	+158
3	270 38.9	257 14.7	•• 26.4	207 55.5	•• 36.8	213 02.9	•• 25.5	69 04.4	•• 06.1	291 33.4	111	• 5 57.0	+158
4	285 41.4	272 16.6	26.1	222 56.1	37.1	228 04.7	25.7	84 07.0	06.1	306 03.5	112	5 41.2	+158
5	300 43.8	287 18.6	25.8	237 56.7	37.5	243 06.6	25.8	99 09.6	06.0	320 33.7	111	5 25.4	+159
6	315 46.3	302 20.5	+ 7 25.4	252 57.4	+21 37.8	258 08.5	+19 25.9	114 12.2	− 6 05.9	335 03.8	112	− 5 09.5	+159
7	330 48.8	317 22.5	25.1	267 58.0	38.1	273 10.3	26.0	129 14.9	05.9	349 34.0	111	4 53.6	+160
8	345 51.2	332 24.4	24.7	282 58.6	38.5	288 12.2	26.2	144 17.5	05.8	4 04.1	112	4 37.6	+159
9	0 53.7	347 26.3	•• 24.4	297 59.3	•• 38.8	303 14.1	•• 26.3	159 20.1	•• 05.8	18 34.3	112	• 4 21.7	+161
10	15 56.2	2 28.2	24.1	312 59.9	39.1	318 15.9	26.4	174 22.7	05.7	33 04.5	112	4 05.6	+160
11	30 58.6	17 30.1	23.8	328 00.5	39.5	333 17.8	26.6	189 25.3	05.7	47 34.7	112	3 49.6	+161
12	46 01.1	32 32.1	+ 7 23.4	343 01.2	+21 39.8	348 19.6	+19 26.7	204 27.9	− 6 05.6	62 04.9	112	− 3 33.5	+161
13	61 03.6	47 34.0	23.1	358 01.8	40.1	3 21.5	26.8	219 30.6	05.6	76 35.1	112	3 17.4	+161
14	76 06.0	62 35.9	22.8	13 02.4	40.5	18 23.4	26.9	234 33.2	05.5	91 05.3	112	3 01.3	+161
15	91 08.5	77 37.8	•• 22.5	28 03.1	•• 40.8	33 25.2	•• 27.1	249 35.8	•• 05.4	105 35.5	112	• 2 45.2	+162
16	106 10.9	92 39.7	22.1	43 03.7	41.1	48 27.1	27.2	264 38.4	05.4	120 05.7	112	2 29.0	+162
17	121 13.4	107 41.6	21.8	58 04.3	41.5	63 29.0	27.3	279 41.0	05.3	134 35.9	112	2 12.8	+162
18	136 15.9	122 43.5	+ 7 21.5	73 05.0	+21 41.8	78 30.8	+19 27.4	294 43.7	− 6 05.3	149 06.1	112	− 1 56.6	+162
19	151 18.3	137 45.4	21.2	88 05.6	42.1	93 32.7	27.6	309 46.3	05.2	163 36.3	112	1 40.4	+162
20	166 20.8	152 47.3	20.9	103 06.2	42.5	108 34.5	27.7	324 48.9	05.2	178 06.5	112	1 24.2	+163
21	181 23.3	167 49.1	•• 20.6	118 06.9	•• 42.8	123 36.4	•• 27.8	339 51.5	•• 05.1	192 36.7	112	• 1 07.9	+162
22	196 25.7	182 51.0	20.3	133 07.5	43.1	138 38.3	28.0	354 54.1	05.1	207 06.9	111	0 51.7	+163
23	211 28.2	197 52.9	20.0	148 08.1	43.5	153 40.1	28.1	9 56.7	05.0	221 37.0	112	0 35.4	+163
9 0	226 30.7	212 54.8	+ 7 19.7	163 08.8	+21 43.8	168 42.0	+19 28.2	24 59.4	− 6 04.9	236 07.2	112	− 0 19.1	+162
1	241 33.1	227 56.7	19.4	178 09.4	44.1	183 43.8	28.3	40 02.0	04.9	250 37.4	111	− 0 02.9	+163
2	256 35.6	242 58.5	19.1	193 10.0	44.5	198 45.7	28.5	55 04.6	04.8	265 07.5	112	+ 0 13.4	+163
3	271 38.1	258 00.4	•• 18.8	208 10.7	•• 44.8	213 47.6	•• 28.6	70 07.2	•• 04.8	279 37.7	111	• 0 29.7	+163
4	286 40.5	273 02.3	18.5	223 11.3	45.1	228 49.4	28.7	85 09.8	04.7	294 07.8	111	0 46.0	+163
5	301 43.0	288 04.1	18.2	238 11.9	45.5	243 51.3	28.9	100 12.5	04.7	308 37.9	111	1 02.3	+163
6	316 45.4	303 06.0	+ 7 17.9	253 12.6	+21 45.8	258 53.2	+19 29.0	115 15.1	− 6 04.6	323 08.0	111	+ 1 18.6	+163
7	331 47.9	318 07.8	17.6	268 13.2	46.1	273 55.0	29.1	130 17.7	04.6	337 38.1	110	1 34.9	+163
8	346 50.4	333 09.7	17.3	283 13.8	46.4	288 56.9	29.2	145 20.3	04.5	352 08.1	111	1 51.2	+163
9	1 52.8	348 11.5	•• 17.0	298 14.5	•• 46.8	303 58.7	•• 29.4	160 22.9	•• 04.5	6 38.2	110	• 2 07.5	+163
10	16 55.3	3 13.4	16.7	313 15.1	47.1	319 00.6	29.5	175 25.5	04.4	21 08.2	110	2 23.8	+162
11	31 57.8	18 15.2	16.5	328 15.7	47.4	334 02.5	29.6	190 28.2	04.3	35 38.2	110	2 40.0	+163
12	47 00.2	33 17.1	+ 7 16.2	343 16.4	+21 47.7	349 04.3	+19 29.7	205 30.8	− 6 04.3	50 08.2	109	+ 2 56.3	+162
13	62 02.7	48 18.9	15.9	358 17.0	48.1	4 06.2	29.9	220 33.4	04.2	64 38.1	110	3 12.5	+163
14	77 05.2	63 20.7	15.6	13 17.6	48.4	19 08.0	30.0	235 36.0	04.2	79 08.1	109	3 28.8	+162
15	92 07.6	78 22.5	•• 15.3	28 18.3	•• 48.7	34 09.9	•• 30.1	250 38.6	•• 04.1	93 38.0	109	• 3 45.0	+162
16	107 10.1	93 24.4	15.1	43 18.9	49.1	49 11.8	30.3	265 41.2	04.1	108 07.9	108	4 01.2	+161
17	122 12.6	108 26.2	14.8	58 19.5	49.4	64 13.6	30.4	280 43.9	04.0	122 37.7	108	4 17.3	+162
18	137 15.0	123 28.0	+ 7 14.5	73 20.2	+21 49.7	79 15.5	+19 30.5	295 46.5	− 6 04.0	137 07.5	108	+ 4 33.5	+161
19	152 17.5	138 29.8	14.3	88 20.8	50.0	94 17.3	30.6	310 49.1	03.9	151 37.3	108	4 49.6	+162
20	167 19.9	153 31.6	14.0	103 21.4	50.3	109 19.2	30.8	325 51.7	03.9	166 07.1	107	5 05.8	+160
21	182 22.4	168 33.4	•• 13.7	118 22.0	•• 50.7	124 21.1	•• 30.9	340 54.3	•• 03.8	180 36.8	107	• 5 21.8	+161
22	197 24.9	183 35.2	13.5	133 22.7	51.0	139 22.9	31.0	355 56.9	03.7	195 06.5	106	5 37.9	+160
23	212 27.3	198 37.0	13.2	148 23.3	51.3	154 24.8	31.1	10 59.6	03.7	209 36.1	107	5 53.9	+160
24	227 29.8	213 38.9	+ 7 13.0	163 23.9	+21 51.6	169 26.6	+19 31.3	26 02.2	− 6 03.6	224 05.8	105	+ 6 09.9	+160
code	—	+ 19	− 3	+ 6	+ 3	+ 19	+ 1	+ 27	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
7 0	180 52.4	+16 40.2
1	195 52.5	40.9
2	210 52.5	41.6
3	225 52.6	42.3
4	240 52.6	43.0
5	255 52.7	43.7
6	270 52.7	+16 44.4
7	285 52.8	45.1
8	300 52.8	45.8
9	315 52.8	46.5
10	330 52.9	47.2
11	345 52.9	47.9
12	0 53.0	+16 48.6
13	15 53.0	49.3
14	30 53.1	49.9
15	45 53.1	50.6
16	60 53.1	51.3
17	75 53.2	52.0
18	90 53.2	+16 52.7
19	105 53.3	53.4
20	120 53.3	54.1
21	135 53.3	54.8
22	150 53.4	55.4
23	165 53.4	56.1
8 0	180 53.5	+16 56.8
1	195 53.5	57.5
2	210 53.5	58.2
3	225 53.6	58.9
4	240 53.6	16 59.6
5	255 53.6	17 00.2
6	270 53.7	+17 00.9
7	285 53.7	01.6
8	300 53.8	02.3
9	315 53.8	03.0
10	330 53.8	03.6
11	345 53.9	04.3
12	0 53.9	+17 05.0
13	15 53.9	05.7
14	30 54.0	06.4
15	45 54.0	07.0
16	60 54.1	07.7
17	75 54.1	08.4
18	90 54.1	+17 09.1
19	105 54.2	09.7
20	120 54.2	10.4
21	135 54.2	11.1
22	150 54.3	11.8
23	165 54.3	12.4
9 0	180 54.3	+17 13.1
1	195 54.4	13.8
2	210 54.4	14.5
3	225 54.4	15.1
4	240 54.5	15.8
5	255 54.5	16.5
6	270 54.5	+17 17.1
7	285 54.5	17.8
8	300 54.6	18.5
9	315 54.6	19.1
10	330 54.6	19.8
11	345 54.7	20.5
12	0 54.7	+17 21.2
13	15 54.7	21.8
14	30 54.8	22.5
15	45 54.8	23.2
16	60 54.8	23.8
17	75 54.8	24.5
18	90 54.9	+17 25.1
19	105 54.9	25.8
20	120 54.9	26.5
21	135 55.0	27.1
22	150 55.0	27.8
23	165 55.0	28.5
24	180 55.0	+17 29.1
code	−	+ 7

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.2
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.8
34	Alkaid	153 33.7	+49 32.7
55	Al Na'ir	28 40.2	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.6	+28 49.9
51	Altair	62 52.1	+ 8 44.5
2	Ankaa	354 00.3	−42 33.4
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.2	−68 56.7
22	Avior	234 36.8	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.6	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.2	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.3	−18 14.5
27	Dubhe	194 46.3	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.7	+51 29.3
54	Enif	34 31.4	+ 9 39.5
56	Fomalhaut	16 13.7	−29 52.1
31	Gacrux	172 51.0	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 16.3	+74 20.7
57	Markab	14 23.5	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.5	−36 08.7
24	Miapl'dus	221 49.7	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.9	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.7
46	R'alhague	96 48.0	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.3
38	Rigil Kent.	140 53.0	−60 38.9
44	Sabik	103 04.0	−15 40.3
3	Schedar	350 32.7	+56 16.8
45	Shaula	97 22.8	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.8	−43 14.9
49	Vega	81 09.2	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 7	8	9
h	m s	m s	m s
0	+ 3 29.7	+ 3 33.8	+ 3 37.2
6	+ 3 30.8	+ 3 34.7	+ 3 38.0
12	+ 3 31.8	+ 3 35.6	+ 3 38.7
18	+ 3 32.8	+ 3 36.4	+ 3 39.4
24	+ 3 33.8	+ 3 37.2	+ 3 40.1

Lat.	Sunrise	Twlt. begins	Moonrise 7	8	9	10
N °	h m	h m	h m	h m	h m	h m
72	0 30	////	3 31	2 51	2 18	1 46
70	1 48	////	3 11	2 43	2 19	1 55
68	2 25	////	2 55	2 36	2 19	2 02
66	2 51	////	2 42	2 30	2 19	2 08
64	3 11	////	2 31	2 25	2 19	2 13
62	3 27	////	2 21	2 20	2 19	2 18
60	3 40	////	2 13	2 17	2 19	2 22
58	3 52	////	2 06	2 13	2 19	2 26
56	4 02	////	2 00	2 10	2 20	2 29
54	4 10	0 54	1 54	2 07	2 20	2 32
52	4 18	1 33	1 49	2 05	2 20	2 35
50	4 25	1 58	1 44	2 03	2 20	2 37
45	4 40	2 39	1 34	1 58	2 20	2 42
40	4 52	3 06	1 26	1 53	2 20	2 47
35	5 03	3 27	1 18	1 50	2 20	2 51
30	5 12	3 43	1 12	1 47	2 20	2 54
20	5 27	4 09	1 01	1 41	2 20	3 00
10	5 41	4 27	0 51	1 36	2 21	3 06
0	5 53	4 41	0 41	1 32	2 21	3 11
10	6 05	4 53	0 32	1 27	2 21	3 16
20	6 18	5 03	0 22	1 22	2 21	3 21
30	6 33	5 10	0 11	1 16	2 22	3 28
35	6 42	5 14	0 04	1 13	2 22	3 32
40	6 51	5 17	25 09	1 09	2 22	3 36
45	7 03	5 20	25 05	1 05	2 23	3 41
50	7 16	5 24	25 00	1 00	2 23	3 47
52	7 23	5 25	24 57	0 57	2 23	3 50
54	7 30	5 26	24 55	0 55	2 23	3 53
56	7 38	5 27	24 52	0 52	2 23	3 56
58	7 46	5 27	24 48	0 48	2 24	4 00
60	7 57	5 28	24 45	0 45	2 24	4 04
S						

Lat.	Sunset	Twlt. ends	Moonset 7	8	9	10
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	10 46	13 12	15 33	18 03
70	22 11	////	11 03	13 17	15 27	17 44
68	21 32	////	11 17	13 21	15 23	17 29
66	21 05	////	11 28	13 24	15 19	17 17
64	20 45	////	11 38	13 27	15 16	17 08
62	20 28	////	11 45	13 29	15 13	16 59
60	20 15	////	11 52	13 32	15 11	16 52
58	20 03	////	11 58	13 33	15 09	16 46
56	19 53	////	12 03	13 35	15 07	16 40
54	19 44	23 09	12 08	13 37	15 05	16 36
52	19 36	22 26	12 12	13 38	15 04	16 31
50	19 29	22 00	12 16	13 39	15 02	16 27
45	19 14	21 17	12 24	13 42	15 00	16 19
40	19 01	20 48	12 31	13 44	14 57	16 11
35	18 51	20 27	12 37	13 46	14 55	16 05
30	18 42	20 11	12 42	13 47	14 53	16 00
20	18 26	19 45	12 51	13 50	14 50	15 51
10	18 13	19 27	12 58	13 53	14 47	15 43
0	18 00	19 12	13 05	13 55	14 44	15 35
10	17 48	19 01	13 12	13 57	14 42	15 27
20	17 34	18 50	13 20	13 59	14 39	15 19
30	17 19	18 41	13 28	14 02	14 35	15 10
35	17 11	18 38	13 33	14 03	14 34	15 05
40	17 01	18 34	13 38	14 05	14 32	14 59
45	16 50	18 31	13 44	14 07	14 29	14 52
50	16 36	18 27	13 52	14 09	14 26	14 44
52	16 30	18 27	13 55	14 10	14 25	14 40
54	16 22	18 25	13 59	14 11	14 23	14 36
56	16 15	18 25	14 03	14 13	14 22	14 32
58	16 06	18 23	14 07	14 14	14 20	14 27
60	15 56	18 23	14 12	14 15	14 18	14 21
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
7	6 53	9 53	13 09	12 50	22 25
8	7 43	9 50	13 08	12 47	22 20
9	8 33	9 47	13 07	12 44	22 16
10	9 23	9 44	13 06	12 41	22 12

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.4	0.1
30	0.2	0.3	0.0
45	0.2	0.2	0.0
60	0.2	0.2	0.0
75	0.2	0.1	0.0
90			

Moon's Lower Limb Add

Alt.	7	8	9
°	′	′	′
0	18.6	19.0	19.2
4	18.6	19.0	19.2
8	18.6	18.9	19.2
12	18.5	18.9	19.2
16	18.5	18.9	19.1
20	18.4	18.8	19.0
24	18.4	18.7	18.9
28	18.3	18.6	18.9
32	18.2	18.5	18.7
36	18.1	18.4	18.6
40	18.0	18.3	18.5
44	17.9	18.2	18.4
48	17.7	18.0	18.2
52	17.6	17.9	18.0
56	17.5	17.7	17.9
60	17.3	17.6	17.7
64	17.2	17.4	17.5
68	17.0	17.2	17.3
72	16.9	17.0	17.1
76	16.7	16.8	16.9
80	16.5	16.7	16.7
84	16.4	16.5	16.5
88	16.2	16.3	16.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	7	8	9
°	′	′	′
0	13.8	13.6	13.4
4	13.8	13.6	13.5
8	13.8	13.6	13.5
12	13.9	13.7	13.5
16	13.9	13.7	13.6
20	14.0	13.8	13.7
24	14.0	13.9	13.7
28	14.1	13.9	13.8
32	14.2	14.0	13.9
36	14.3	14.2	14.1
40	14.4	14.3	14.2
44	14.5	14.4	14.3
48	14.7	14.5	14.5
52	14.8	14.7	14.6
56	14.9	14.9	14.8
60	15.1	15.0	15.0
64	15.2	15.2	15.2
68	15.4	15.4	15.3
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.9	15.9	15.9
84	16.0	16.1	16.1
88	16.2	16.2	16.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
10 0	227 29.8	213 38.9	+ 7 13.0	163 23.9	+21 51.6	169 26.6	+19 31.3	26 02.2	− 6 03.6	224 05.8	105	+ 6 09.9	+160
1	242 32.3	228 40.6	12.7	178 24.6	52.0	184 28.5	31.4	41 04.8	03.6	238 35.3	106	6 25.9	+160
2	257 34.7	243 42.4	12.4	193 25.2	52.3	199 30.4	31.5	56 07.4	03.5	253 04.9	105	6 41.9	+159
3	272 37.2	258 44.2	12.2	208 25.8	52.6	214 32.2	31.6	71 10.0	03.5	267 34.4	104	6 57.8	+158
4	287 39.7	273 46.0	11.9	223 26.5	52.9	229 34.1	31.8	86 12.6	03.4	282 03.8	105	7 13.6	+158
5	302 42.1	288 47.8	11.7	238 27.1	53.2	244 35.9	31.9	101 15.2	03.4	296 33.3	103	7 29.4	+158
6	317 44.6	303 49.6	+ 7 11.4	253 27.7	+21 53.6	259 37.8	+19 32.0	116 17.9	− 6 03.3	311 02.6	104	+ 7 45.2	+158
7	332 47.0	318 51.4	11.2	268 28.4	53.9	274 39.7	32.2	131 20.5	03.3	325 32.0	103	8 01.0	+157
8	347 49.5	333 53.1	11.0	283 29.0	54.2	289 41.5	32.3	146 23.1	03.2	340 01.3	102	8 16.7	+156
9	2 52.0	348 54.9	10.7	298 29.6	54.5	304 43.4	32.4	161 25.7	03.2	354 30.5	102	8 32.3	+156
10	17 54.4	3 56.7	10.5	313 30.3	54.8	319 45.3	32.5	176 28.3	03.1	8 59.7	102	8 47.9	+156
11	32 56.9	18 58.4	10.2	328 30.9	55.2	334 47.1	32.7	191 30.9	03.0	23 28.9	101	9 03.5	+155
12	47 59.4	34 00.2	+ 7 10.0	343 31.5	+21 55.5	349 49.0	+19 32.8	206 33.6	− 6 03.0	37 58.0	100	+ 9 19.0	+155
13	63 01.8	49 02.0	09.8	358 32.1	55.8	4 50.8	32.9	221 36.2	02.9	52 27.0	100	9 34.5	+154
14	78 04.3	64 03.7	09.5	13 32.8	56.1	19 52.7	33.0	236 38.8	02.9	66 56.0	100	9 49.9	+153
15	93 06.8	79 05.5	09.3	28 33.4	56.4	34 54.6	33.2	251 41.4	02.8	81 25.0	99	10 05.2	+153
16	108 09.2	94 07.2	09.1	43 34.0	56.7	49 56.4	33.3	266 44.0	02.8	95 53.9	99	10 20.5	+152
17	123 11.7	109 09.0	08.8	58 34.7	57.1	64 58.3	33.4	281 46.6	02.7	110 22.8	98	10 35.7	+152
18	138 14.2	124 10.7	+ 7 08.6	73 35.3	+21 57.4	80 00.1	+19 33.5	296 49.2	− 6 02.7	124 51.6	97	+10 50.9	+151
19	153 16.6	139 12.5	08.4	88 35.9	57.7	95 02.0	33.7	311 51.9	02.6	139 20.3	97	11 06.0	+151
20	168 19.1	154 14.2	08.2	103 36.6	58.0	110 03.8	33.8	326 54.5	02.6	153 49.0	96	11 21.1	+149
21	183 21.5	169 15.9	08.0	118 37.2	58.3	125 05.7	33.9	341 57.1	02.5	168 17.6	96	11 36.0	+149
22	198 24.0	184 17.7	07.7	133 37.8	58.6	140 07.6	34.0	356 59.7	02.5	182 46.2	95	11 50.9	+149
23	213 26.5	199 19.4	07.5	148 38.5	59.0	155 09.4	34.2	12 02.3	02.4	197 14.7	95	12 05.8	+147
11 0	228 28.9	214 21.1	+ 7 07.3	163 39.1	+21 59.3	170 11.3	+19 34.3	27 04.9	− 6 02.4	211 43.2	94	+12 20.5	+147
1	243 31.4	229 22.8	07.1	178 39.7	59.6	185 13.1	34.4	42 07.5	02.3	226 11.6	93	12 35.2	+147
2	258 33.9	244 24.5	06.9	193 40.3	21 59.9	200 15.0	34.6	57 10.1	02.3	240 39.9	93	12 49.9	+145
3	273 36.3	259 26.3	06.7	208 41.0	22 00.2	215 16.9	34.7	72 12.8	02.2	255 08.2	92	13 04.4	+145
4	288 38.8	274 28.0	06.5	223 41.6	00.5	230 18.7	34.8	87 15.4	02.1	269 36.4	92	13 18.9	+143
5	303 41.3	289 29.7	06.3	238 42.2	00.8	245 20.6	34.9	102 18.0	02.1	284 04.6	91	13 33.2	+144
6	318 43.7	304 31.4	+ 7 06.1	253 42.9	+22 01.1	260 22.4	+19 35.1	117 20.6	− 6 02.0	298 32.7	90	+13 47.6	+142
7	333 46.2	319 33.1	05.9	268 43.5	01.5	275 24.3	35.2	132 23.2	02.0	313 00.7	90	14 01.8	+141
8	348 48.7	334 34.8	05.7	283 44.1	01.8	290 26.2	35.3	147 25.8	01.9	327 28.7	89	14 15.9	+141
9	3 51.1	349 36.5	05.5	298 44.8	02.1	305 28.0	35.4	162 28.4	01.9	341 56.6	89	14 30.0	+139
10	18 53.6	4 38.2	05.3	313 45.4	02.4	320 29.9	35.6	177 31.0	01.8	356 24.5	87	14 43.9	+139
11	33 56.0	19 39.9	05.1	328 46.0	02.7	335 31.7	35.7	192 33.7	01.8	10 52.2	88	14 57.8	+138
12	48 58.5	34 41.6	+ 7 04.9	343 46.6	+22 03.0	350 33.6	+19 35.8	207 36.3	− 6 01.7	25 20.0	86	+15 11.6	+136
13	64 01.0	49 43.3	04.7	358 47.3	03.3	5 35.5	35.9	222 38.9	01.7	39 47.6	86	15 25.2	+136
14	79 03.4	64 44.9	04.5	13 47.9	03.6	20 37.3	36.1	237 41.5	01.6	54 15.2	85	15 38.8	+135
15	94 05.9	79 46.6	04.3	28 48.5	03.9	35 39.2	36.2	252 44.1	01.6	68 42.7	85	15 52.3	+134
16	109 08.4	94 48.3	04.1	43 49.2	04.2	50 41.0	36.3	267 46.7	01.5	83 10.2	84	16 05.7	+133
17	124 10.8	109 50.0	04.0	58 49.8	04.6	65 42.9	36.4	282 49.3	01.5	97 37.6	83	16 19.0	+132
18	139 13.3	124 51.7	+ 7 03.8	73 50.4	+22 04.9	80 44.7	+19 36.6	297 51.9	− 6 01.4	112 04.9	83	+16 32.2	+131
19	154 15.8	139 53.3	03.6	88 51.1	05.2	95 46.6	36.7	312 54.6	01.4	126 32.2	81	16 45.3	+130
20	169 18.2	154 55.0	03.4	103 51.7	05.5	110 48.5	36.8	327 57.2	01.3	140 59.3	82	16 58.3	+129
21	184 20.7	169 56.6	03.2	118 52.3	05.8	125 50.3	36.9	342 59.8	01.3	155 26.5	80	17 11.2	+127
22	199 23.2	184 58.3	03.1	133 52.9	06.1	140 52.2	37.1	358 02.4	01.2	169 53.5	80	17 23.9	+127
23	214 25.6	200 00.0	02.9	148 53.6	06.4	155 54.0	37.2	13 05.0	01.2	184 20.5	79	17 36.6	+125
12 0	229 28.1	215 01.6	+ 7 02.7	163 54.2	+22 06.7	170 55.9	+19 37.3	28 07.6	− 6 01.1	198 47.4	79	+17 49.1	+125
1	244 30.5	230 03.3	02.6	178 54.8	07.0	185 57.8	37.4	43 10.2	01.0	213 14.3	78	18 01.6	+123
2	259 33.0	245 04.9	02.4	193 55.5	07.3	200 59.6	37.6	58 12.8	01.0	227 41.1	77	18 13.9	+122
3	274 35.5	260 06.6	02.2	208 56.1	07.6	216 01.5	37.7	73 15.4	00.9	242 07.8	77	18 26.1	+121
4	289 37.9	275 08.2	02.1	223 56.7	07.9	231 03.3	37.8	88 18.1	00.9	256 34.5	76	18 38.2	+119
5	304 40.4	290 09.8	01.9	238 57.3	08.2	246 05.2	37.9	103 20.7	00.8	271 01.1	75	18 50.1	+119
6	319 42.9	305 11.5	+ 7 01.7	253 58.0	+22 08.5	261 07.0	+19 38.1	118 23.3	− 6 00.8	285 27.6	74	+19 02.0	+117
7	334 45.3	320 13.1	01.6	268 58.6	08.8	276 08.9	38.2	133 25.9	00.7	299 54.0	74	19 13.7	+116
8	349 47.8	335 14.7	01.4	283 59.2	09.1	291 10.8	38.3	148 28.5	00.7	314 20.4	74	19 25.3	+114
9	4 50.3	350 16.4	01.3	298 59.9	09.4	306 12.6	38.4	163 31.1	00.6	328 46.8	72	+19 36.7	+114
10	19 52.7	5 18.0	01.1	314 00.5	09.7	321 14.5	38.6	178 33.7	00.6	343 13.0	72	19 48.1	+112
11	34 55.2	20 19.6	01.0	329 01.1	10.0	336 16.3	38.7	193 36.3	00.5	357 39.2	72	19 59.3	+111
12	49 57.7	35 21.2	+ 7 00.8	344 01.7	+22 10.3	351 18.2	+19 38.8	208 38.9	− 6 00.5	12 05.4	70	+20 10.4	+109
13	65 00.1	50 22.9	00.7	359 02.4	10.6	6 20.1	38.9	223 41.5	00.4	26 31.4	70	20 21.3	+108
14	80 02.6	65 24.5	00.5	14 03.0	10.9	21 21.9	39.1	238 44.2	00.4	40 57.4	70	20 32.1	+107
15	95 05.0	80 26.1	00.4	29 03.6	11.2	36 23.8	39.2	253 46.8	00.3	55 23.4	69	20 42.8	+106
16	110 07.5	95 27.7	00.2	44 04.3	11.5	51 25.6	39.3	268 49.4	00.3	69 49.3	68	20 53.4	+104
17	125 10.0	110 29.3	00.1	59 04.9	11.8	66 27.5	39.4	283 52.0	00.2	84 15.1	68	21 03.8	+103
18	140 12.4	125 30.9	+ 7 00.0	74 05.5	+22 12.1	81 29.3	+19 39.6	298 54.6	− 6 00.2	98 40.9	67	+21 14.1	+101
19	155 14.9	140 32.5	6 59.8	89 06.1	12.4	96 31.2	39.7	313 57.2	00.1	113 06.6	66	21 24.2	+100
20	170 17.4	155 34.1	59.7	104 06.8	12.7	111 33.1	39.8	328 59.8	00.1	127 32.2	66	21 34.2	+ 98
21	185 19.8	170 35.7	59.6	119 07.4	13.0	126 34.9	39.9	344 02.4	00.0	141 57.8	65	+21 44.0	+ 97
22	200 22.3	185 37.3	59.4	134 08.0	13.3	141 36.8	40.1	359 05.0	6 00.0	156 23.3	65	21 53.7	+ 96
23	215 24.8	200 38.9	59.3	149 08.6	13.6	156 38.6	40.2	14 07.6	5 59.9	170 48.8	64	22 03.3	+ 94
24	230 27.2	215 40.4	+ 6 59.2	164 09.3	+22 13.9	171 40.5	+19 40.3	29 10.3	− 5 59.9	185 14.2	64	+22 12.7	+ 93
code	−	+ 17	− 2	+ 7	+ 3	+ 19	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
10 0	180 55.0	+17 29.1
1	195 55.1	29.8
2	210 55.1	30.4
3	225 55.1	31.1
4	240 55.1	31.8
5	255 55.2	32.4
6	270 55.2	+17 33.1
7	285 55.2	33.7
8	300 55.2	34.4
9	315 55.3	35.0
10	330 55.3	35.7
11	345 55.3	36.4
12	0 55.3	+17 37.0
13	15 55.4	37.7
14	30 55.4	38.3
15	45 55.4	39.0
16	60 55.4	39.6
17	75 55.5	40.3
18	90 55.5	+17 40.9
19	105 55.5	41.6
20	120 55.5	42.2
21	135 55.6	42.9
22	150 55.6	43.5
23	165 55.6	44.2
11 0	180 55.6	+17 44.8
1	195 55.6	45.5
2	210 55.7	46.1
3	225 55.7	46.8
4	240 55.7	47.4
5	255 55.7	48.1
6	270 55.7	+17 48.7
7	285 55.8	49.4
8	300 55.8	50.0
9	315 55.8	50.7
10	330 55.8	51.3
11	345 55.8	51.9
12	0 55.8	+17 52.6
13	15 55.9	53.2
14	30 55.9	53.9
15	45 55.9	54.5
16	60 55.9	55.2
17	75 55.9	55.8
18	90 55.9	+17 56.4
19	105 56.0	57.1
20	120 56.0	57.7
21	135 56.0	58.3
22	150 56.0	59.0
23	165 56.0	17 59.6
12 0	180 56.0	+18 00.3
1	195 56.1	00.9
2	210 56.1	01.5
3	225 56.1	02.2
4	240 56.1	02.8
5	255 56.1	03.4
6	270 56.1	+18 04.1
7	285 56.1	04.7
8	300 56.1	05.3
9	315 56.2	06.0
10	330 56.2	06.6
11	345 56.2	07.2
12	0 56.2	+18 07.9
13	15 56.2	08.5
14	30 56.2	09.1
15	45 56.2	09.7
16	60 56.2	10.4
17	75 56.3	11.0
18	90 56.3	+18 11.6
19	105 56.3	12.2
20	120 56.3	12.9
21	135 56.3	13.5
22	150 56.3	14.1
23	165 56.3	14.7
24	180 56.3	+18 15.4
code	−	+ 6

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.9	−40 29.4
5	Achernar	336 00.6	−57 28.2
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.8
34	Alkaid	153 33.7	+49 32.7
55	Al Na'ir	28 40.2	−47 11.1
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.0
1	Alpheratz	358 30.5	+28 49.9
51	Altair	62 52.1	+ 8 44.5
2	Ankaa	354 00.3	−42 33.4
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.2	−68 56.8
22	Avior	234 36.8	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.6	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.2	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.3	−18 14.5
27	Dubhe	194 46.4	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.7	+51 29.3
54	Enif	34 31.4	+ 9 39.5
56	Fomalhaut	16 13.7	−29 52.1
31	Gacrux	172 51.0	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 16.3	+74 20.7
57	Markab	14 23.4	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.5	−36 08.7
24	Miapl'dus	221 49.8	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.9	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.7
46	R'alhague	96 48.0	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 04.0	−15 40.3
3	Schedar	350 32.7	+56 16.8
45	Shaula	97 22.8	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.8	−43 14.9
49	Vega	81 09.2	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 10	11	12
h	m s	m s	m s
0	+ 3 40.1	+ 3 42.4	+ 3 44.1
6	+ 3 40.7	+ 3 42.9	+ 3 44.5
12	+ 3 41.3	+ 3 43.3	+ 3 44.8
18	+ 3 41.9	+ 3 43.7	+ 3 45.0
24	+ 3 42.4	+ 3 44.1	+ 3 45.3

Lat.	Sunrise	Twlt. begins	Moonrise 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	1 46	1 04 / 23 35	▭	▭
70	1 25	////	1 55	1 26	0 39	▭
68	2 10	////	2 02	1 43	1 15	▭
66	2 39	////	2 08	1 56	1 41	1 15
64	3 01	////	2 13	2 08	2 01	1 54
62	3 18	////	2 18	2 17	2 18	2 21
60	3 33	////	2 22	2 26	2 32	2 42
58	3 45	////	2 26	2 33	2 44	3 00
56	3 55	////	2 29	2 40	2 54	3 15
54	4 05	0 25	2 32	2 46	3 04	3 28
52	4 13	1 20	2 35	2 51	3 12	3 39
50	4 20	1 48	2 37	2 56	3 19	3 49
45	4 36	2 32	2 42	3 07	3 35	4 10
40	4 49	3 02	2 47	3 16	3 49	4 27
35	5 00	3 24	2 51	3 23	4 00	4 42
30	5 09	3 41	2 54	3 30	4 10	4 55
20	5 26	4 07	3 00	3 42	4 27	5 17
10	5 40	4 26	3 06	3 52	4 42	5 35
0	5 53	4 41	3 11	4 02	4 56	5 53
10	6 06	4 53	3 16	4 12	5 11	6 11
20	6 19	5 03	3 21	4 23	5 26	6 31
30	6 35	5 12	3 28	4 35	5 44	6 53
35	6 44	5 16	3 32	4 43	5 55	7 07
40	6 54	5 20	3 36	4 51	6 07	7 22
45	7 06	5 24	3 41	5 00	6 21	7 40
50	7 21	5 27	3 47	5 12	6 39	8 03
52	7 28	5 29	3 50	5 18	6 47	8 14
54	7 35	5 30	3 53	5 24	6 56	8 27
56	7 43	5 31	3 56	5 31	7 07	8 41
58	7 53	5 33	4 00	5 38	7 19	8 58
60	8 04	5 33	4 04	5 47	7 33	9 19
S						

Lat.	Sunset	Twlt. ends	Moonset 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	18 03	21 25	▭	▭
70	22 35	////	17 44	20 23	▭	▭
68	21 47	////	17 29	19 49	▭	▭
66	21 17	////	17 17	19 24	21 48	▭
64	20 54	////	17 08	19 05	21 10	23 26
62	20 37	////	16 59	18 49	20 43	22 36
60	20 22	////	16 52	18 37	20 23	22 04
58	20 09	////	16 46	18 25	20 06	21 41
56	19 59	////	16 40	18 16	19 51	21 22
54	19 49	////	16 36	18 07	19 39	21 06
52	19 41	22 40	16 31	18 00	19 28	20 52
50	19 33	22 09	16 27	17 53	19 19	20 40
45	19 17	21 23	16 19	17 39	18 59	20 16
40	19 04	20 53	16 11	17 27	18 43	19 56
35	18 53	20 30	16 05	17 17	18 29	19 40
30	18 44	20 14	16 00	17 08	18 17	19 25
20	18 27	19 47	15 51	16 53	17 57	19 01
10	18 13	19 27	15 43	16 40	17 40	18 41
0	18 00	19 12	15 35	16 28	17 23	18 21
10	17 47	19 00	15 27	16 16	17 07	18 02
20	17 33	18 49	15 19	16 03	16 50	17 41
30	17 17	18 39	15 10	15 48	16 30	17 18
35	17 08	18 35	15 05	15 39	16 18	17 04
40	16 58	18 31	14 59	15 30	16 05	16 48
45	16 46	18 27	14 52	15 18	15 50	16 28
50	16 31	18 23	14 44	15 05	15 31	16 05
52	16 24	18 22	14 40	14 59	15 22	15 53
54	16 17	18 21	14 36	14 52	15 12	15 40
56	16 08	18 19	14 32	14 44	15 01	15 25
58	15 59	18 18	14 27	14 35	14 48	15 08
60	15 48	18 16	14 21	14 25	14 33	14 47
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
10	9 23	9 44	13 06	12 41	22 12
11	10 15	9 42	13 05	12 38	22 08
12	11 10	9 39	13 04	12 35	22 04
13	12 07	9 36	13 03	12 32	22 00

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.4	0.1
30	0.2	0.3	0.0
45	0.2	0.2	0.0
60	0.2	0.1	0.0
75	0.2	0.1	0.0
90			

Moon's Lower Limb **Add**

Alt.	10	11	12
°	′	′	′
0	19.4	19.1	18.7
4	19.4	19.1	18.7
8	19.3	19.1	18.7
12	19.3	19.0	18.7
16	19.2	19.0	18.6
20	19.2	18.9	18.6
24	19.1	18.8	18.5
28	19.0	18.7	18.4
32	18.9	18.6	18.3
36	18.7	18.5	18.2
40	18.6	18.4	18.1
44	18.5	18.3	18.0
48	18.3	18.1	17.8
52	18.1	18.0	17.7
56	18.0	17.8	17.6
60	17.8	17.6	17.4
64	17.6	17.5	17.2
68	17.4	17.3	17.1
72	17.2	17.1	16.9
76	17.0	16.9	16.8
80	16.8	16.7	16.6
84	16.6	16.5	16.4
88	16.4	16.4	16.3
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	10	11	12
°	′	′	′
0	13.4	13.5	13.7
4	13.4	13.5	13.7
8	13.4	13.6	13.8
12	13.5	13.6	13.8
16	13.5	13.6	13.9
20	13.6	13.7	13.9
24	13.7	13.8	14.0
28	13.8	13.9	14.1
32	13.9	14.0	14.2
36	14.0	14.1	14.3
40	14.1	14.2	14.4
44	14.3	14.4	14.5
48	14.4	14.5	14.6
52	14.6	14.7	14.8
56	14.8	14.8	14.9
60	15.0	15.0	15.1
64	15.1	15.2	15.2
68	15.3	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.9	15.9	15.9
84	16.2	16.1	16.1
88	16.3	16.3	16.2
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
13 0	230 27.2	215 40.4	+ 6 59.2	164 09.3	+22 13.9	171 40.5	+19 40.3	29 10.3	− 5 59.9	185 14.2	64	+22 12.7	+ 93
1	245 29.7	230 42.0	59.0	179 09.9	14.2	186 42.3	40.4	44 12.9	59.8	199 39.6	63	22 22.0	+ 91
2	260 32.1	245 43.6	58.9	194 10.5	14.5	201 44.2	40.6	59 15.5	59.8	214 04.9	62	22 31.1	+ 89
3	275 34.6	260 45.2	58.8	209 11.2	14.8	216 46.1	40.7	74 18.1	59.7	228 30.1	62	22 40.0	+ 89
4	290 37.1	275 46.8	58.7	224 11.8	15.1	231 47.9	40.8	89 20.7	59.7	242 55.3	62	22 48.9	+ 86
5	305 39.5	290 48.3	58.6	239 12.4	15.4	246 49.8	40.9	104 23.3	59.6	257 20.5	61	22 57.5	+ 85
6	320 42.0	305 49.9	+ 6 58.4	254 13.0	+22 15.7	261 51.6	+19 41.1	119 25.9	− 5 59.6	271 45.6	60	+23 06.0	+ 84
7	335 44.5	320 51.5	58.3	269 13.7	16.0	276 53.5	41.2	134 28.5	59.5	286 10.6	60	23 14.4	+ 82
8	350 46.9	335 53.0	58.2	284 14.3	16.3	291 55.3	41.3	149 31.1	59.5	300 35.6	60	23 22.6	+ 80
9	5 49.4	350 54.6	58.1	299 14.9	16.6	306 57.2	41.4	164 33.7	59.4	315 00.6	59	+23 30.6	+ 79
10	20 51.9	5 56.1	58.0	314 15.5	16.9	321 59.1	41.6	179 36.3	59.4	329 25.5	59	23 38.5	+ 78
11	35 54.3	20 57.7	57.9	329 16.2	17.2	337 00.9	41.7	194 38.9	59.3	343 50.4	58	23 46.3	+ 75
12	50 56.8	35 59.3	+ 6 57.8	344 16.8	+22 17.5	352 02.8	+19 41.8	209 41.6	− 5 59.3	358 15.2	58	+23 53.8	+ 75
13	65 59.3	51 00.8	57.7	359 17.4	17.8	7 04.6	41.9	224 44.2	59.2	12 40.0	58	24 01.3	+ 72
14	81 01.7	66 02.4	57.6	14 18.1	18.1	22 06.5	42.1	239 46.8	59.2	27 04.8	57	24 08.5	+ 71
15	96 04.2	81 03.9	57.5	29 18.7	18.3	37 08.3	42.2	254 49.4	59.1	41 29.5	57	+24 15.6	+ 69
16	111 06.6	96 05.4	57.4	44 19.3	18.6	52 10.2	42.3	269 52.0	59.1	55 54.2	57	24 22.5	+ 68
17	126 09.1	111 07.0	57.3	59 19.9	18.9	67 12.1	42.4	284 54.6	59.0	70 18.9	56	24 29.3	+ 66
18	141 11.6	126 08.5	+ 6 57.2	74 20.6	+22 19.2	82 13.9	+19 42.6	299 57.2	− 5 59.0	84 43.5	56	+24 35.9	+ 64
19	156 14.0	141 10.0	57.1	89 21.2	19.5	97 15.8	42.7	314 59.8	58.9	99 08.1	55	24 42.3	+ 63
20	171 16.5	156 11.6	57.0	104 21.8	19.8	112 17.6	42.8	330 02.4	58.9	113 32.6	56	24 48.6	+ 61
21	186 19.0	171 13.1	56.9	119 22.4	20.1	127 19.5	42.9	345 05.0	58.8	127 57.2	55	+24 54.7	+ 60
22	201 21.4	186 14.6	56.8	134 23.1	20.4	142 21.3	43.0	0 07.6	58.8	142 21.7	55	25 00.7	+ 57
23	216 23.9	201 16.1	56.7	149 23.7	20.7	157 23.2	43.2	15 10.2	58.7	156 46.2	54	25 06.4	+ 56
14 0	231 26.4	216 17.7	+ 6 56.6	164 24.3	+22 21.0	172 25.1	+19 43.3	30 12.8	− 5 58.7	171 10.6	55	+25 12.0	+ 55
1	246 28.8	231 19.2	56.5	179 24.9	21.2	187 26.9	43.4	45 15.4	58.6	185 35.1	54	25 17.5	+ 53
2	261 31.3	246 20.7	56.4	194 25.6	21.5	202 28.8	43.5	60 18.0	58.6	199 59.5	54	25 22.8	+ 51
3	276 33.8	261 22.2	56.4	209 26.2	21.8	217 30.6	43.7	75 20.7	58.5	214 23.9	54	+25 27.9	+ 49
4	291 36.2	276 23.7	56.3	224 26.8	22.1	232 32.5	43.8	90 23.3	58.5	228 48.3	54	25 32.8	+ 48
5	306 38.7	291 25.2	56.2	239 27.5	22.4	247 34.3	43.9	105 25.9	58.4	243 12.7	54	25 37.6	+ 45
6	321 41.1	306 26.7	+ 6 56.1	254 28.1	+22 22.7	262 36.2	+19 44.0	120 28.5	− 5 58.4	257 37.1	53	+25 42.1	+ 45
7	336 43.6	321 28.2	56.1	269 28.7	23.0	277 38.0	44.2	135 31.1	58.3	272 01.4	54	25 46.6	+ 42
8	351 46.1	336 29.7	56.0	284 29.3	23.2	292 39.9	44.3	150 33.7	58.3	286 25.8	53	25 50.8	+ 41
9	6 48.5	351 31.2	55.9	299 30.0	23.5	307 41.8	44.4	165 36.3	58.2	300 50.1	54	+25 54.9	+ 39
10	21 51.0	6 32.7	55.8	314 30.6	23.8	322 43.6	44.5	180 38.9	58.2	315 14.5	53	25 58.8	+ 38
11	36 53.5	21 34.2	55.8	329 31.2	24.1	337 45.5	44.7	195 41.5	58.1	329 38.8	54	26 02.6	+ 35
12	51 55.9	36 35.7	+ 6 55.7	344 31.8	+22 24.4	352 47.3	+19 44.8	210 44.1	− 5 58.1	344 03.2	54	+26 06.1	+ 34
13	66 58.4	51 37.2	55.6	359 32.5	24.7	7 49.2	44.9	225 46.7	58.0	358 27.6	53	26 09.5	+ 33
14	82 00.9	66 38.6	55.6	14 33.1	25.0	22 51.0	45.0	240 49.3	58.0	12 51.9	54	26 12.8	+ 30
15	97 03.3	81 40.1	55.5	29 33.7	25.2	37 52.9	45.1	255 51.9	57.9	27 16.3	54	+26 15.8	+ 29
16	112 05.8	96 41.6	55.5	44 34.3	25.5	52 54.8	45.3	270 54.5	57.9	41 40.7	54	26 18.7	+ 27
17	127 08.3	111 43.1	55.4	59 35.0	25.8	67 56.6	45.4	285 57.1	57.8	56 05.1	54	26 21.4	+ 26
18	142 10.7	126 44.5	+ 6 55.3	74 35.6	+22 26.1	82 58.5	+19 45.5	300 59.7	− 5 57.8	70 29.5	54	+26 24.0	+ 23
19	157 13.2	141 46.0	55.3	89 36.2	26.4	98 00.3	45.6	316 02.3	57.7	84 53.9	54	26 26.3	+ 22
20	172 15.6	156 47.5	55.2	104 36.8	26.6	113 02.2	45.8	331 04.9	57.7	99 18.3	55	26 28.5	+ 21
21	187 18.1	171 48.9	55.2	119 37.5	26.9	128 04.0	45.9	346 07.5	57.6	113 42.8	54	+26 30.6	+ 18
22	202 20.6	186 50.4	55.1	134 38.1	27.2	143 05.9	46.0	1 10.1	57.6	128 07.2	55	26 32.4	+ 17
23	217 23.0	201 51.8	55.1	149 38.7	27.5	158 07.7	46.1	16 12.7	57.5	142 31.7	56	26 34.1	+ 15
15 0	232 25.5	216 53.3	+ 6 55.0	164 39.3	+22 27.8	173 09.6	+19 46.3	31 15.4	− 5 57.5	156 56.3	55	+26 35.6	+ 14
1	247 28.0	231 54.8	55.0	179 40.0	28.0	188 11.5	46.4	46 18.0	57.4	171 20.8	56	26 37.0	+ 12
2	262 30.4	246 56.2	54.9	194 40.6	28.3	203 13.3	46.5	61 20.6	57.4	185 45.4	56	26 38.2	+ 10
3	277 32.9	261 57.7	54.9	209 41.2	28.6	218 15.2	46.6	76 23.2	57.4	200 10.0	57	+26 39.2	+ 8
4	292 35.4	276 59.1	54.9	224 41.8	28.9	233 17.0	46.7	91 25.8	57.3	214 34.7	57	26 40.0	+ 7
5	307 37.8	292 00.5	54.8	239 42.5	29.2	248 18.9	46.9	106 28.4	57.3	228 59.4	57	26 40.7	+ 5
6	322 40.3	307 02.0	+ 6 54.8	254 43.1	+22 29.4	263 20.7	+19 47.0	121 31.0	− 5 57.2	243 24.1	58	+26 41.2	+ 4
7	337 42.7	322 03.4	54.7	269 43.7	29.7	278 22.6	47.1	136 33.6	57.2	257 48.9	58	26 41.6	+ 1
8	352 45.2	337 04.9	54.7	284 44.3	30.0	293 24.4	47.2	151 36.2	57.1	272 13.7	58	26 41.7	+ 1
9	7 47.7	352 06.3	54.7	299 45.0	30.3	308 26.3	47.4	166 38.8	57.1	286 38.5	59	+26 41.8	− 2
10	22 50.1	7 07.7	54.7	314 45.6	30.6	323 28.2	47.5	181 41.4	57.0	301 03.4	59	26 41.6	− 3
11	37 52.6	22 09.1	54.6	329 46.2	30.8	338 30.0	47.6	196 44.0	57.0	315 28.3	60	26 41.3	− 5
12	52 55.1	37 10.6	+ 6 54.6	344 46.8	+22 31.1	353 31.9	+19 47.7	211 46.6	− 5 56.9	329 53.3	61	+26 40.8	− 6
13	67 57.5	52 12.0	54.6	359 47.5	31.4	8 33.7	47.9	226 49.2	56.9	344 18.4	61	26 40.2	− 9
14	83 00.0	67 13.4	54.5	14 48.1	31.7	23 35.6	48.0	241 51.8	56.8	358 43.5	61	26 39.3	− 9
15	98 02.5	82 14.8	54.5	29 48.7	31.9	38 37.4	48.1	256 54.4	56.8	13 08.6	62	+26 38.4	− 12
16	113 04.9	97 16.2	54.5	44 49.3	32.2	53 39.3	48.2	271 57.0	56.7	27 33.8	63	26 37.2	− 13
17	128 07.4	112 17.6	54.5	59 50.0	32.5	68 41.1	48.3	286 59.6	56.7	41 59.1	63	26 35.9	− 14
18	143 09.9	127 19.1	+ 6 54.5	74 50.6	+22 32.8	83 43.0	+19 48.5	302 02.2	− 5 56.6	56 24.4	64	+26 34.5	− 16
19	158 12.3	142 20.5	54.5	89 51.2	33.0	98 44.9	48.6	317 04.8	56.6	70 49.8	64	26 32.9	− 18
20	173 14.8	157 21.9	54.4	104 51.8	33.3	113 46.7	48.7	332 07.4	56.5	85 15.2	66	26 31.1	− 19
21	188 17.2	172 23.3	54.4	119 52.5	33.6	128 48.6	48.8	347 10.0	56.5	99 40.8	65	+26 29.2	− 21
22	203 19.7	187 24.7	54.4	134 53.1	33.8	143 50.4	49.0	2 12.6	56.4	114 06.3	67	26 27.1	− 22
23	218 22.2	202 26.1	54.4	149 53.7	34.1	158 52.3	49.1	17 15.2	56.4	128 32.0	67	26 24.9	− 24
24	233 24.6	217 27.4	+ 6 54.4	164 54.3	+22 34.4	173 54.1	+19 49.2	32 17.8	− 5 56.4	142 57.7	68	+26 22.5	− 26
code	−	+ 15	− 1	+ 7	+ 3	+ 19	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
13 0	180 56.3	+18 15.4
1	195 56.3	16.0
2	210 56.3	16.6
3	225 56.3	17.2
4	240 56.3	17.9
5	255 56.4	18.5
6	270 56.4	+18 19.1
7	285 56.4	19.7
8	300 56.4	20.3
9	315 56.4	21.0
10	330 56.4	21.6
11	345 56.4	22.2
12	0 56.4	+18 22.8
13	15 56.4	23.4
14	30 56.4	24.1
15	45 56.4	24.7
16	60 56.4	25.3
17	75 56.4	25.9
18	90 56.4	+18 26.5
19	105 56.4	27.1
20	120 56.4	27.7
21	135 56.4	28.3
22	150 56.4	29.0
23	165 56.5	29.6
14 0	180 56.5	+18 30.2
1	195 56.5	30.8
2	210 56.5	31.4
3	225 56.5	32.0
4	240 56.5	32.6
5	255 56.5	33.2
6	270 56.5	+18 33.8
7	285 56.5	34.4
8	300 56.5	35.1
9	315 56.5	35.7
10	330 56.5	36.3
11	345 56.5	36.9
12	0 56.5	+18 37.5
13	15 56.5	38.1
14	30 56.5	38.7
15	45 56.5	39.3
16	60 56.5	39.9
17	75 56.5	40.5
18	90 56.5	+18 41.1
19	105 56.5	41.7
20	120 56.5	42.3
21	135 56.5	42.9
22	150 56.5	43.5
23	165 56.5	44.1
15 0	180 56.4	+18 44.7
1	195 56.4	45.3
2	210 56.4	45.9
3	225 56.4	46.5
4	240 56.4	47.1
5	255 56.4	47.7
6	270 56.4	+18 48.3
7	285 56.4	48.8
8	300 56.4	49.4
9	315 56.4	50.0
10	330 56.4	50.6
11	345 56.4	51.2
12	0 56.4	+18 51.8
13	15 56.4	52.4
14	30 56.4	53.0
15	45 56.4	53.6
16	60 56.4	54.2
17	75 56.4	54.8
18	90 56.4	+18 55.3
19	105 56.3	55.9
20	120 56.3	56.5
21	135 56.3	57.1
22	150 56.3	57.7
23	165 56.3	58.3
24	180 56.3	+18 58.9
code	−	+ 6

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.3
5	Achernar	336 00.6	−57 28.2
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.5	+56 12.8
34	Alkaid	153 33.8	+49 32.7
55	Al Na'ir	28 40.2	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.1
1	Alpheratz	358 30.5	+28 49.9
51	Altair	62 52.1	+ 8 44.5
2	Ankaa	354 00.3	−42 33.3
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.2	−68 56.8
22	Avior	234 36.9	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.6	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.2	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.3	−18 14.4
27	Dubhe	194 46.4	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.3
54	Enif	34 31.4	+ 9 39.5
56	Fomalhaut	16 13.7	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 16.3	+74 20.7
57	Markab	14 23.4	+14 57.1
8	Menkar	315 02.6	+ 3 54.5
36	Menkent	149 00.5	−36 08.7
24	Miapl'dus	221 49.8	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.7
46	R'alhague	96 48.0	+12 35.3
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 04.0	−15 40.3
3	Schedar	350 32.6	+56 16.8
45	Shaula	97 22.8	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.8	−43 14.9
49	Vega	81 09.2	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 13	14	15
h	m s	m s	m s
0	+ 3 45.3	+ 3 45.8	+ 3 45.8
6	+ 3 45.4	+ 3 45.9	+ 3 45.7
12	+ 3 45.6	+ 3 45.9	+ 3 45.6
18	+ 3 45.7	+ 3 45.8	+ 3 45.4
24	+ 3 45.8	+ 3 45.8	+ 3 45.2

Lat. N °	Sunrise h m	Twlt. begins h m
72	▭	▭
70	0 56	////
68	1 54	////
66	2 27	////
64	2 51	////
62	3 10	////
60	3 25	////
58	3 38	////
56	3 50	////
54	3 59	////
52	4 08	1 04
50	4 16	1 37
45	4 33	2 27
40	4 46	2 57
35	4 57	3 20
30	5 07	3 38
20	5 24	4 05
10	5 39	4 24
0	5 53	4 40
10	6 06	4 53
20	6 21	5 04
30	6 37	5 13
35	6 46	5 18
40	6 57	5 22
45	7 10	5 26
50	7 25	5 30
52	7 32	5 32
54	7 40	5 34
56	7 49	5 36
58	7 59	5 37
60	8 10	5 39
S		

Lat. N °	Sunset h m	Twlt. ends h m
72	▭	▭
70	23 08	////
68	22 03	////
66	21 29	////
64	21 04	////
62	20 45	////
60	20 29	////
58	20 16	////
56	20 04	////
54	19 54	////
52	19 46	22 56
50	19 38	22 20
45	19 21	21 29
40	19 07	20 57
35	18 56	20 35
30	18 46	20 16
20	18 28	19 48
10	18 14	19 29
0	18 00	19 13
10	17 46	18 59
20	17 32	18 48
30	17 15	18 38
35	17 06	18 33
40	16 55	18 29
45	16 43	18 25
50	16 27	18 20
52	16 20	18 18
54	16 12	18 17
56	16 03	18 15
58	15 53	18 13
60	15 42	18 12

Lat. N °	Moonrise 13 h m	14 h m	15 h m	16 h m
72	▭	▭	▭	▭
70	▭	▭	▭	▭
68	▭	▭	▭	▭
66	1 15	▭	▭	▭
64	1 54	1 40	▭	▭
62	2 21	2 31	3 00	4 10
60	2 42	3 03	3 41	4 48
58	3 00	3 26	4 10	5 15
56	3 15	3 46	4 32	5 36
54	3 28	4 02	4 50	5 53
52	3 39	4 16	5 05	6 08
50	3 49	4 28	5 19	6 21
45	4 10	4 53	5 46	6 47
40	4 27	5 14	6 08	7 08
35	4 42	5 31	6 26	7 26
30	4 55	5 45	6 41	7 41
20	5 17	6 10	7 08	8 06
10	5 35	6 32	7 30	8 28
0	5 53	6 52	7 51	8 49
10	6 11	7 13	8 13	9 09
20	6 31	7 35	8 35	9 31
30	6 53	8 00	9 02	9 56
35	7 07	8 15	9 17	10 11
40	7 22	8 33	9 36	10 28
45	7 40	8 54	9 57	10 49
50	8 03	9 20	10 25	11 15
52	8 14	9 33	10 39	11 28
54	8 27	9 48	10 54	11 42
56	8 41	10 06	11 13	11 59
58	8 58	10 27	11 36	12 19
60	9 19	10 55	12 05	12 44
S				

Lat. N °	Moonset 13 h m	14 h m	15 h m	16 h m
72	▭	▭	▭	▭
70	▭	▭	▭	▭
68	▭	▭	▭	▭
66	▭	▭	▭	▭
64	23 26	▭	▭	▭
62	22 36	24 10	0 10	1 01
60	22 04	23 29	24 23	0 23
58	21 41	23 01	23 56	24 30
56	21 22	22 39	23 35	24 12
54	21 06	22 21	23 18	23 57
52	20 52	22 05	23 03	23 44
50	20 40	21 52	22 50	23 33
45	20 16	21 25	22 23	23 09
40	19 56	21 03	22 02	22 49
35	19 40	20 46	21 44	22 33
30	19 25	20 30	21 29	22 19
20	19 01	20 04	21 03	21 55
10	18 41	19 42	20 40	21 34
0	18 21	19 21	20 19	21 15
10	18 02	19 00	19 58	20 55
20	17 41	18 37	19 36	20 34
30	17 18	18 11	19 09	20 10
35	17 04	17 56	18 54	19 56
40	16 48	17 38	18 36	19 39
45	16 28	17 16	18 14	19 19
50	16 05	16 49	17 46	18 53
52	15 53	16 36	17 33	18 41
54	15 40	16 21	17 17	18 27
56	15 25	16 03	16 59	18 10
58	15 08	15 42	16 36	17 50
60	14 47	15 14	16 07	17 26

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
13	12 07	9 36	13 03	12 32	22 00
14	13 06	9 34	13 02	12 29	21 55
15	14 05	9 32	13 01	12 26	21 51
16	15 02	9 29	13 00	12 23	21 47

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.2	0.4	0.1
30	0.2	0.3	0.0
45	0.2	0.2	0.0
60	0.2	0.1	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	13 ′	14 ′	15 ′
0	18.0	17.1	16.2
4	18.0	17.1	16.2
8	17.9	17.1	16.2
12	17.9	17.0	16.2
16	17.9	17.0	16.2
20	17.8	17.0	16.2
24	17.8	17.0	16.1
28	17.7	16.9	16.1
32	17.6	16.9	16.1
36	17.6	16.8	16.1
40	17.5	16.8	16.1
44	17.4	16.7	16.0
48	17.3	16.6	16.0
52	17.2	16.6	16.0
56	17.1	16.5	16.0
60	17.0	16.4	15.9
64	16.8	16.4	15.9
68	16.7	16.3	15.9
72	16.6	16.2	15.8
76	16.5	16.1	15.8
80	16.3	16.0	15.8
84	16.2	16.0	15.7
88	16.1	15.9	15.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	13 ′	14 ′	15 ′
0	14.2	14.7	15.2
4	14.2	14.7	15.2
8	14.2	14.7	15.2
12	14.2	14.7	15.2
16	14.3	14.7	15.2
20	14.3	14.8	15.2
24	14.4	14.8	15.2
28	14.4	14.8	15.3
32	14.5	14.9	15.3
36	14.6	14.9	15.3
40	14.7	15.0	15.3
44	14.7	15.0	15.3
48	14.8	15.1	15.4
52	15.0	15.2	15.4
56	15.1	15.2	15.4
60	15.2	15.3	15.5
64	15.3	15.4	15.5
68	15.4	15.5	15.5
72	15.5	15.5	15.5
76	15.7	15.6	15.6
80	15.8	15.7	15.6
84	15.9	15.8	15.7
88	16.0	15.9	15.7
90			

Subtract from table, back cover

New Moon 13
Ascension Day 14

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.6 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
16 0	233 24.6	217 27.4	+ 6 54.4	164 54.3	+22 34.4	173 54.1	+19 49.2	32 17.8	− 5 56.4	142 57.7	68	+26 22.5	− 26
1	248 27.1	232 28.8	54.4	179 55.0	34.7	188 56.0	49.3	47 20.4	56.3	157 23.5	68	26 19.9	− 27
2	263 29.6	247 30.2	54.4	194 55.6	34.9	203 57.8	49.4	62 23.0	56.3	171 49.3	70	26 17.2	− 28
3	278 32.0	262 31.6	•• 54.4	209 56.2	•• 35.2	218 59.7	•• 49.6	77 25.6	•• 56.2	186 15.3	70	•26 14.4	− 30
4	293 34.5	277 33.0	54.4	224 56.8	35.5	234 01.5	49.7	92 28.2	56.2	200 41.3	71	26 11.4	− 32
5	308 37.0	292 34.4	54.4	239 57.5	35.7	249 03.4	49.8	107 30.8	56.1	215 07.4	71	26 08.2	− 33
6	323 39.4	307 35.8	+ 6 54.4	254 58.1	+22 36.0	264 05.3	+19 49.9	122 33.4	− 5 56.1	229 33.5	73	+26 04.9	− 34
7	338 41.9	322 37.1	54.4	269 58.7	36.3	279 07.1	50.1	137 36.0	56.0	243 59.8	73	26 01.5	− 36
8	353 44.4	337 38.5	54.4	284 59.3	36.5	294 09.0	50.2	152 38.6	56.0	258 26.1	74	25 57.9	− 37
9	8 46.8	352 39.9	•• 54.4	300 00.0	•• 36.8	309 10.8	•• 50.3	167 41.2	•• 55.9	272 52.5	75	•25 54.2	− 39
10	23 49.3	7 41.2	54.4	315 00.6	37.1	324 12.7	50.4	182 43.8	55.9	287 19.0	75	25 50.3	− 40
11	38 51.7	22 42.6	54.4	330 01.2	37.3	339 14.5	50.5	197 46.4	55.8	301 45.5	77	25 46.3	− 42
12	53 54.2	37 44.0	+ 6 54.4	345 01.8	+22 37.6	354 16.4	+19 50.7	212 49.0	− 5 55.8	316 12.2	77	+25 42.1	− 43
13	68 56.7	52 45.3	54.4	0 02.5	37.9	9 18.2	50.8	227 51.6	55.7	330 38.9	78	25 37.8	− 45
14	83 59.1	67 46.7	54.4	15 03.1	38.1	24 20.1	50.9	242 54.2	55.7	345 05.7	79	25 33.3	− 45
15	99 01.6	82 48.0	•• 54.5	30 03.7	•• 38.4	39 21.9	•• 51.0	257 56.8	•• 55.7	359 32.6	80	•25 28.8	− 48
16	114 04.1	97 49.4	54.5	45 04.3	38.7	54 23.8	51.1	272 59.4	55.6	13 59.6	81	25 24.0	− 48
17	129 06.5	112 50.8	54.5	60 04.9	38.9	69 25.7	51.3	288 02.0	55.6	28 26.7	82	25 19.2	− 50
18	144 09.0	127 52.1	+ 6 54.5	75 05.6	+22 39.2	84 27.5	+19 51.4	303 04.6	− 5 55.5	42 53.9	83	+25 14.2	− 51
19	159 11.5	142 53.4	54.5	90 06.2	39.5	99 29.4	51.5	318 07.2	55.5	57 21.2	83	25 09.1	− 53
20	174 13.9	157 54.8	54.6	105 06.8	39.7	114 31.2	51.6	333 09.8	55.4	71 48.5	85	25 03.8	− 54
21	189 16.4	172 56.1	•• 54.6	120 07.4	•• 40.0	129 33.1	•• 51.8	348 12.4	•• 55.4	86 16.0	85	•24 58.4	− 55
22	204 18.9	187 57.5	54.6	135 08.1	40.3	144 34.9	51.9	3 15.0	55.3	100 43.5	87	24 52.9	− 56
23	219 21.3	202 58.8	54.6	150 08.7	40.5	159 36.8	52.0	18 17.6	55.3	115 11.2	87	24 47.3	− 58
17 0	234 23.8	218 00.1	+ 6 54.7	165 09.3	+22 40.8	174 38.6	+19 52.1	33 20.2	− 5 55.2	129 38.9	88	+24 41.5	− 59
1	249 26.2	233 01.5	54.7	180 09.9	41.1	189 40.5	52.2	48 22.8	55.2	144 06.7	90	24 35.6	− 60
2	264 28.7	248 02.8	54.7	195 10.6	41.3	204 42.3	52.4	63 25.4	55.1	158 34.7	90	24 29.6	− 62
3	279 31.2	263 04.1	•• 54.8	210 11.2	•• 41.6	219 44.2	•• 52.5	78 28.0	•• 55.1	173 02.7	91	•24 23.4	− 63
4	294 33.6	278 05.5	54.8	225 11.8	41.8	234 46.1	52.6	93 30.6	55.1	187 30.8	92	24 17.1	− 64
5	309 36.1	293 06.8	54.8	240 12.4	42.1	249 47.9	52.7	108 33.2	55.0	201 59.0	93	24 10.7	− 65
6	324 38.6	308 08.1	+ 6 54.9	255 13.1	+22 42.4	264 49.8	+19 52.8	123 35.8	− 5 55.0	216 27.3	94	+24 04.2	− 66
7	339 41.0	323 09.4	54.9	270 13.7	42.6	279 51.6	53.0	138 38.4	54.9	230 55.7	96	23 57.6	− 68
8	354 43.5	338 10.7	55.0	285 14.3	42.9	294 53.5	53.1	153 41.0	54.9	245 24.3	96	23 50.8	− 68
9	9 46.0	353 12.0	•• 55.0	300 14.9	•• 43.1	309 55.3	•• 53.2	168 43.6	•• 54.8	259 52.9	97	•23 44.0	− 70
10	24 48.4	8 13.3	55.1	315 15.5	43.4	324 57.2	53.3	183 46.2	54.8	274 21.6	98	23 37.0	− 71
11	39 50.9	23 14.7	55.1	330 16.2	43.7	339 59.0	53.5	198 48.8	54.7	288 50.4	99	23 29.9	− 72
12	54 53.4	38 16.0	+ 6 55.1	345 16.8	+22 43.9	355 00.9	+19 53.6	213 51.4	− 5 54.7	303 19.3	100	+23 22.7	− 73
13	69 55.8	53 17.3	55.2	0 17.4	44.2	10 02.7	53.7	228 54.0	54.6	317 48.3	101	23 15.4	− 74
14	84 58.3	68 18.6	55.2	15 18.0	44.4	25 04.6	53.8	243 56.6	54.6	332 17.4	102	23 08.0	− 76
15	100 00.7	83 19.9	•• 55.3	30 18.7	•• 44.7	40 06.4	•• 53.9	258 59.2	•• 54.6	346 46.6	102	•23 00.4	− 76
16	115 03.2	98 21.2	55.4	45 19.3	45.0	55 08.3	54.1	274 01.8	54.5	1 15.8	104	22 52.8	− 78
17	130 05.7	113 22.4	55.4	60 19.9	45.2	70 10.2	54.2	289 04.4	54.5	15 45.2	105	22 45.0	− 78
18	145 08.1	128 23.7	+ 6 55.5	75 20.5	+22 45.5	85 12.0	+19 54.3	304 07.0	− 5 54.4	30 14.7	106	+22 37.2	− 80
19	160 10.6	143 25.0	55.5	90 21.2	45.7	100 13.9	54.4	319 09.6	54.4	44 44.3	107	22 29.2	− 80
20	175 13.1	158 26.3	55.6	105 21.8	46.0	115 15.7	54.5	334 12.2	54.3	59 14.0	108	22 21.2	− 82
21	190 15.5	173 27.6	•• 55.6	120 22.4	•• 46.2	130 17.6	•• 54.7	349 14.8	•• 54.3	73 43.8	109	•22 13.0	− 83
22	205 18.0	188 28.9	55.7	135 23.0	46.5	145 19.4	54.8	4 17.4	54.2	88 13.7	110	22 04.7	− 83
23	220 20.5	203 30.2	55.8	150 23.6	46.7	160 21.3	54.9	19 19.9	54.2	102 43.7	111	21 56.4	− 85
18 0	235 22.9	218 31.4	+ 6 55.8	165 24.3	+22 47.0	175 23.1	+19 55.0	34 22.5	− 5 54.1	117 13.8	111	+21 47.9	− 85
1	250 25.4	233 32.7	55.9	180 24.9	47.2	190 25.0	55.1	49 25.1	54.1	131 43.9	113	21 39.4	− 87
2	265 27.8	248 34.0	56.0	195 25.5	47.5	205 26.8	55.3	64 27.7	54.1	146 14.2	114	21 30.7	− 87
3	280 30.3	263 35.2	•• 56.0	210 26.1	•• 47.8	220 28.7	•• 55.4	79 30.3	•• 54.0	160 44.6	115	•21 22.0	− 89
4	295 32.8	278 36.5	56.1	225 26.8	48.0	235 30.5	55.5	94 32.9	54.0	175 15.1	115	21 13.1	− 89
5	310 35.2	293 37.8	56.2	240 27.4	48.3	250 32.4	55.6	109 35.5	53.9	189 45.6	117	21 04.2	− 90
6	325 37.7	308 39.0	+ 6 56.3	255 28.0	+22 48.5	265 34.3	+19 55.7	124 38.1	− 5 53.9	204 16.3	118	+20 55.2	− 91
7	340 40.2	323 40.3	56.3	270 28.6	48.8	280 36.1	55.9	139 40.7	53.8	218 47.1	118	20 46.1	− 92
8	355 42.6	338 41.6	56.4	285 29.2	49.0	295 38.0	56.0	154 43.3	53.8	233 17.9	120	20 36.9	− 93
9	10 45.1	353 42.8	•• 56.5	300 29.9	•• 49.3	310 39.8	•• 56.1	169 45.9	•• 53.7	247 48.9	120	•20 27.6	− 94
10	25 47.6	8 44.1	56.6	315 30.5	49.5	325 41.7	56.2	184 48.5	53.7	262 19.9	121	20 18.2	− 94
11	40 50.0	23 45.3	56.7	330 31.1	49.8	340 43.5	56.3	199 51.1	53.7	276 51.0	123	20 08.8	− 95
12	55 52.5	38 46.6	+ 6 56.7	345 31.7	+22 50.0	355 45.4	+19 56.5	214 53.7	− 5 53.6	291 22.3	123	+19 59.3	− 97
13	70 55.0	53 47.8	56.8	0 32.4	50.3	10 47.2	56.6	229 56.3	53.6	305 53.6	124	19 49.6	− 97
14	85 57.4	68 49.1	56.9	15 33.0	50.5	25 49.1	56.7	244 58.9	53.5	320 25.0	125	19 39.9	− 97
15	100 59.9	83 50.3	•• 57.0	30 33.6	•• 50.8	40 50.9	•• 56.8	260 01.5	•• 53.5	334 56.5	126	•19 30.2	− 99
16	116 02.3	98 51.5	57.1	45 34.2	51.0	55 52.8	56.9	275 04.1	53.4	349 28.1	127	19 20.3	− 99
17	131 04.8	113 52.8	57.2	60 34.8	51.3	70 54.6	57.1	290 06.7	53.4	3 59.8	128	19 10.4	−100
18	146 07.3	128 54.0	+ 6 57.3	75 35.5	+22 51.5	85 56.5	+19 57.2	305 09.2	− 5 53.4	18 31.6	128	+19 00.4	−101
19	161 09.7	143 55.2	57.4	90 36.1	51.8	100 58.3	57.3	320 11.8	53.3	33 03.4	130	18 50.3	−102
20	176 12.2	158 56.5	57.5	105 36.7	52.0	116 00.2	57.4	335 14.4	53.3	47 35.4	130	18 40.1	−102
21	191 14.7	173 57.7	•• 57.6	120 37.3	•• 52.3	131 02.0	•• 57.5	350 17.0	•• 53.2	62 07.4	132	•18 29.9	−103
22	206 17.1	188 58.9	57.7	135 38.0	52.5	146 03.9	57.7	5 19.6	53.2	76 39.6	132	18 19.6	−104
23	221 19.6	204 00.2	57.8	150 38.6	52.7	161 05.8	57.8	20 22.2	53.1	91 11.8	133	18 09.2	−104
24	236 22.1	219 01.4	+ 6 57.9	165 39.2	+22 53.0	176 07.6	+19 57.9	35 24.8	− 5 53.1	105 44.1	134	+17 58.8	−105
code	—	+ 13	+ 1	+ 6	+ 3	+ 18	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
16 0	180 56.3	+18 58.9
1	195 56.3	18 59.4
2	210 56.3	19 00.0
3	225 56.3	•• 00.6
4	240 56.3	01.2
5	255 56.3	01.8
6	270 56.2	+19 02.4
7	285 56.2	02.9
8	300 56.2	03.5
9	315 56.2	•• 04.1
10	330 56.2	04.7
11	345 56.2	05.3
12	0 56.2	+19 05.8
13	15 56.2	06.4
14	30 56.2	07.0
15	45 56.1	•• 07.6
16	60 56.1	08.1
17	75 56.1	08.7
18	90 56.1	+19 09.3
19	105 56.1	09.9
20	120 56.1	10.4
21	135 56.1	•• 11.0
22	150 56.0	11.6
23	165 56.0	12.1
17 0	180 56.0	+19 12.7
1	195 56.0	13.3
2	210 56.0	13.9
3	225 56.0	•• 14.4
4	240 56.0	15.0
5	255 55.9	15.6
6	270 55.9	+19 16.1
7	285 55.9	16.7
8	300 55.9	17.3
9	315 55.9	•• 17.8
10	330 55.9	18.4
11	345 55.8	19.0
12	0 55.8	+19 19.5
13	15 55.8	20.1
14	30 55.8	20.7
15	45 55.8	•• 21.2
16	60 55.7	21.8
17	75 55.7	22.3
18	90 55.7	+19 22.9
19	105 55.7	23.5
20	120 55.7	24.0
21	135 55.7	•• 24.6
22	150 55.6	25.1
23	165 55.6	25.7
18 0	180 55.6	+19 26.2
1	195 55.6	26.8
2	210 55.5	27.4
3	225 55.5	•• 27.9
4	240 55.5	28.5
5	255 55.5	29.0
6	270 55.5	+19 29.6
7	285 55.4	30.1
8	300 55.4	30.7
9	315 55.4	•• 31.2
10	330 55.4	31.8
11	345 55.4	32.3
12	0 55.3	+19 32.9
13	15 55.3	33.4
14	30 55.3	34.0
15	45 55.3	•• 34.5
16	60 55.2	35.1
17	75 55.2	35.6
18	90 55.2	+19 36.2
19	105 55.2	36.7
20	120 55.1	37.3
21	135 55.1	•• 37.8
22	150 55.1	38.4
23	165 55.1	38.9
24	180 55.0	+19 39.4
code	−	+ 6

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.3
5	Achernar	336 00.5	−57 28.2
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.2	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.6	+56 12.8
34	Alkaid	153 33.8	+49 32.7
55	Al Na'ir	28 40.1	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.1
1	Alpheratz	358 30.5	+28 49.9
51	Altair	62 52.0	+ 8 44.5
2	Ankaa	354 00.2	−42 33.3
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.1	−68 56.8
22	Avior	234 36.9	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.6	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.2	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.3	−18 14.4
27	Dubhe	194 46.4	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.4
54	Enif	34 31.4	+ 9 39.5
56	Fomalhaut	16 13.7	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.1	+23 14.6
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 16.3	+74 20.7
57	Markab	14 23.4	+14 57.2
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 49.8	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.7
46	R'alhague	96 48.0	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.6	+56 16.8
45	Shaula	97 22.8	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.8	−43 14.9
49	Vega	81 09.2	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 16	17	18
h	m s	m s	m s
0	+ 3 45.2	+ 3 44.1	+ 3 42.4
6	+ 3 45.0	+ 3 43.7	+ 3 41.9
12	+ 3 44.7	+ 3 43.3	+ 3 41.4
18	+ 3 44.4	+ 3 42.9	+ 3 40.8
24	+ 3 44.1	+ 3 42.4	+ 3 40.2

Lat.	Sunrise	Twlt. begins	Moonrise 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	▭	▭	6 40
70	▭	▭	▭	▭	▭	7 32
68	1 37	////	▭	▭	5 39	8 04
66	2 15	////	▭	▭	6 31	8 27
64	2 41	////	▭	5 08	7 02	8 46
62	3 02	////	4 10	5 47	7 26	9 00
60	3 18	////	4 48	6 14	7 45	9 13
58	3 32	////	5 15	6 35	8 00	9 24
56	3 44	////	5 36	6 52	8 13	9 33
54	3 54	////	5 53	7 07	8 24	9 41
52	4 04	0 45	6 08	7 20	8 34	9 48
50	4 12	1 27	6 21	7 31	8 43	9 55
45	4 29	2 20	6 47	7 54	9 02	10 09
40	4 43	2 53	7 08	8 13	9 17	10 20
35	4 55	3 17	7 26	8 28	9 30	10 30
30	5 06	3 35	7 41	8 42	9 41	10 39
20	5 23	4 03	8 06	9 04	10 00	10 53
10	5 39	4 24	8 28	9 24	10 17	11 06
0	5 53	4 40	8 49	9 43	10 32	11 18
10	6 07	4 54	9 09	10 01	10 48	11 30
20	6 22	5 05	9 31	10 20	11 04	11 43
30	6 39	5 15	9 56	10 43	11 23	11 57
35	6 49	5 20	10 11	10 56	11 33	12 05
40	7 00	5 25	10 28	11 11	11 46	12 15
45	7 13	5 30	10 49	11 29	12 01	12 26
50	7 29	5 34	11 15	11 51	12 18	12 39
52	7 37	5 36	11 28	12 02	12 27	12 45
54	7 45	5 38	11 42	12 14	12 36	12 52
56	7 54	5 39	11 59	12 28	12 47	12 59
58	8 05	5 42	12 19	12 44	12 58	13 08
60	8 17	5 44	12 44	13 03	13 12	13 18
S						

Lat.	Sunset	Twlt. ends	Moonset 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	▭	▭	3 53
70	▭	▭	▭	▭	▭	2 59
68	22 21	////	▭	▭	3 14	2 26
66	21 41	////	▭	▭	2 21	2 01
64	21 14	////	▭	1 59	1 49	1 42
62	20 53	////	1 01	1 19	1 25	1 26
60	20 36	////	0 23	0 51	1 06	1 13
58	20 22	////	24 30	0 30	0 50	1 02
56	20 10	////	24 12	0 12	0 36	0 52
54	19 59	////	23 57	24 24	0 24	0 43
52	19 50	23 15	23 44	24 14	0 14	0 35
50	19 42	22 31	23 33	24 04	0 04	0 28
45	19 24	21 35	23 09	23 44	24 12	0 12
40	19 10	21 02	22 49	23 28	24 00	0 00
35	18 58	20 38	22 33	23 14	23 49	24 18
30	18 48	20 19	22 19	23 02	23 39	24 11
20	18 30	19 51	21 55	22 42	23 23	24 00
10	18 14	19 29	21 34	22 24	23 08	23 49
0	18 00	19 13	21 15	22 07	22 55	23 39
10	17 46	18 59	20 55	21 50	22 41	23 29
20	17 31	18 48	20 34	21 32	22 26	23 18
30	17 14	18 37	20 10	21 10	22 09	23 06
35	17 04	18 32	19 56	20 58	21 59	22 58
40	16 52	18 26	19 39	20 44	21 48	22 50
45	16 39	18 22	19 19	20 26	21 34	22 40
50	16 23	18 17	18 53	20 05	21 18	22 29
52	16 15	18 14	18 41	19 55	21 10	22 23
54	16 07	18 13	18 27	19 43	21 01	22 17
56	15 58	18 11	18 10	19 30	20 51	22 10
58	15 47	18 09	17 50	19 15	20 40	22 02
60	15 35	18 07	17 26	18 56	20 27	21 54
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
16	15 02	9 29	13 00	12 23	21 47
17	15 55	9 27	12 59	12 20	21 43
18	16 44	9 25	12 58	12 17	21 39
19	17 29	9 23	12 57	12 14	21 35

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.3	0.1
30	0.1	0.3	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	16	17	18
°	′	′	′
0	15.2	14.3	13.4
4	15.2	14.3	13.4
8	15.2	14.3	13.4
12	15.2	14.3	13.4
16	15.2	14.3	13.5
20	15.2	14.4	13.5
24	15.2	14.4	13.6
28	15.2	14.4	13.6
32	15.2	14.4	13.7
36	15.2	14.5	13.7
40	15.2	14.5	13.8
44	15.3	14.6	13.9
48	15.3	14.6	14.0
52	15.3	14.7	14.1
56	15.3	14.7	14.2
60	15.3	14.8	14.3
64	15.3	14.9	14.4
68	15.4	14.9	14.5
72	15.4	15.0	14.6
76	15.4	15.1	14.7
80	15.4	15.1	14.9
84	15.4	15.2	15.0
88	15.5	15.3	15.1
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	16	17	18
°	′	′	′
0	15.8	16.3	16.8
4	15.8	16.3	16.8
8	15.8	16.3	16.8
12	15.8	16.2	16.7
16	15.8	16.2	16.7
20	15.7	16.2	16.7
24	15.7	16.2	16.6
28	15.7	16.1	16.6
32	15.7	16.1	16.5
36	15.7	16.1	16.4
40	15.7	16.0	16.4
44	15.7	16.0	16.3
48	15.7	15.9	16.2
52	15.6	15.9	16.1
56	15.6	15.8	16.0
60	15.6	15.7	15.9
64	15.6	15.7	15.8
68	15.6	15.6	15.7
72	15.6	15.6	15.6
76	15.5	15.5	15.4
80	15.5	15.4	15.3
84	15.5	15.3	15.2
88	15.5	15.3	15.1
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
19 0	236 22.1	219 01.4	+ 6 57.9	165 39.2	+22 53.0	176 07.6	+19 57.9	35 24.8	− 5 53.1	105 44.1	134	+17 58.8	105
1	251 24.5	234 02.6	58.0	180 39.8	53.2	191 09.5	58.0	50 27.4	53.0	120 16.5	134	17 48.3	106
2	266 27.0	249 03.8	58.1	195 40.4	53.5	206 11.3	58.1	65 30.0	53.0	134 48.9	136	17 37.7	107
3	281 29.4	264 05.0	•• 58.2	210 41.1	•• 53.7	221 13.2	•• 58.3	80 32.6	•• 53.0	149 21.5	136	•17 27.0	107
4	296 31.9	279 06.2	58.3	225 41.7	54.0	236 15.0	58.4	95 35.2	52.9	163 54.1	137	17 16.3	108
5	311 34.4	294 07.5	58.4	240 42.3	54.2	251 16.9	58.5	110 37.8	52.9	178 26.8	138	17 05.5	108
6	326 36.8	309 08.7	+ 6 58.5	255 42.9	+22 54.5	266 18.7	+19 58.6	125 40.4	− 5 52.8	192 59.6	139	+16 54.7	109
7	341 39.3	324 09.9	58.6	270 43.5	54.7	281 20.6	58.7	140 43.0	52.8	207 32.5	140	16 43.8	110
8	356 41.8	339 11.1	58.7	285 44.2	54.9	296 22.4	58.9	155 45.5	52.7	222 05.5	140	16 32.8	110
9	11 44.2	354 12.3	•• 58.8	300 44.8	•• 55.2	311 24.3	•• 59.0	170 48.1	•• 52.7	236 38.5	141	•16 21.8	111
10	26 46.7	9 13.5	59.0	315 45.4	55.4	326 26.1	59.1	185 50.7	52.7	251 11.6	142	16 10.7	111
11	41 49.2	24 14.7	59.1	330 46.0	55.7	341 28.0	59.2	200 53.3	52.6	265 44.8	143	15 59.6	112
12	56 51.6	39 15.9	+ 6 59.2	345 46.7	+22 55.9	356 29.8	+19 59.3	215 55.9	− 5 52.6	280 18.1	143	+15 48.4	113
13	71 54.1	54 17.1	59.3	0 47.3	56.1	11 31.7	59.4	230 58.5	52.5	294 51.4	144	15 37.1	113
14	86 56.6	69 18.3	59.4	15 47.9	56.4	26 33.5	59.6	246 01.1	52.5	309 24.8	145	15 25.8	114
15	101 59.0	84 19.4	•• 59.6	30 48.5	•• 56.6	41 35.4	•• 59.7	261 03.7	•• 52.4	323 58.3	146	•15 14.4	114
16	117 01.5	99 20.6	59.7	45 49.1	56.9	56 37.3	59.8	276 06.3	52.4	338 31.9	146	15 03.0	115
17	132 03.9	114 21.8	59.8	60 49.8	57.1	71 39.1	19 59.9	291 08.9	52.4	353 05.5	147	14 51.5	115
18	147 06.4	129 23.0	+ 6 59.9	75 50.4	+22 57.3	86 41.0	+20 00.0	306 11.5	− 5 52.3	7 39.2	148	+14 40.0	116
19	162 08.9	144 24.2	7 00.1	90 51.0	57.6	101 42.8	00.2	321 14.1	52.3	22 13.0	148	14 28.4	116
20	177 11.3	159 25.3	00.2	105 51.6	57.8	116 44.7	00.3	336 16.6	52.2	36 46.8	149	14 16.8	117
21	192 13.8	174 26.5	•• 00.3	120 52.2	•• 58.1	131 46.5	•• 00.4	351 19.2	•• 52.2	51 20.7	150	•14 05.1	118
22	207 16.3	189 27.7	00.5	135 52.9	58.3	146 48.4	00.5	6 21.8	52.2	65 54.7	150	13 53.3	117
23	222 18.7	204 28.9	00.6	150 53.5	58.5	161 50.2	00.6	21 24.4	52.1	80 28.7	151	13 41.6	119
20 0	237 21.2	219 30.0	+ 7 00.7	165 54.1	+22 58.8	176 52.1	+20 00.8	36 27.0	− 5 52.1	95 02.8	151	+13 29.7	118
1	252 23.7	234 31.2	00.9	180 54.7	59.0	191 53.9	00.9	51 29.6	52.0	109 36.9	153	13 17.9	120
2	267 26.1	249 32.4	01.0	195 55.4	59.2	206 55.8	01.0	66 32.2	52.0	124 11.2	152	13 05.9	119
3	282 28.6	264 33.5	•• 01.1	210 56.0	•• 59.5	221 57.6	•• 01.1	81 34.8	•• 51.9	138 45.4	154	•12 54.0	120
4	297 31.1	279 34.7	01.3	225 56.6	22 59.7	236 59.5	01.2	96 37.4	51.9	153 19.8	154	12 42.0	121
5	312 33.5	294 35.8	01.4	240 57.2	23 00.0	252 01.3	01.3	111 40.0	51.9	167 54.2	155	12 29.9	121
6	327 36.0	309 37.0	+ 7 01.6	255 57.8	+23 00.2	267 03.2	+20 01.5	126 42.5	− 5 51.8	182 28.7	155	+12 17.8	121
7	342 38.4	324 38.1	01.7	270 58.5	00.4	282 05.0	01.6	141 45.1	51.8	197 03.2	155	12 05.7	122
8	357 40.9	339 39.3	01.8	285 59.1	00.7	297 06.9	01.7	156 47.7	51.7	211 37.7	157	11 53.5	122
9	12 43.4	354 40.4	•• 02.0	300 59.7	•• 00.9	312 08.7	•• 01.8	171 50.3	•• 51.7	226 12.4	157	•11 41.3	123
10	27 45.8	9 41.6	02.1	316 00.3	01.1	327 10.6	01.9	186 52.9	51.7	240 47.1	157	11 29.0	123
11	42 48.3	24 42.7	02.3	331 00.9	01.4	342 12.4	02.1	201 55.5	51.6	255 21.8	158	11 16.7	123
12	57 50.8	39 43.9	+ 7 02.4	346 01.6	+23 01.6	357 14.3	+20 02.2	216 58.1	− 5 51.6	269 56.6	158	+11 04.4	124
13	72 53.2	54 45.0	02.6	1 02.2	01.8	12 16.2	02.3	232 00.7	51.5	284 31.4	159	10 52.0	124
14	87 55.7	69 46.2	02.8	16 02.8	02.1	27 18.0	02.4	247 03.3	51.5	299 06.3	159	10 39.6	124
15	102 58.2	84 47.3	•• 02.9	31 03.4	•• 02.3	42 19.9	•• 02.5	262 05.8	•• 51.4	313 41.2	160	•10 27.2	125
16	118 00.6	99 48.4	03.1	46 04.0	02.5	57 21.7	02.6	277 08.4	51.4	328 16.2	160	10 14.7	125
17	133 03.1	114 49.6	03.2	61 04.7	02.7	72 23.6	02.8	292 11.0	51.4	342 51.2	161	10 02.2	125
18	148 05.6	129 50.7	+ 7 03.4	76 05.3	+23 03.0	87 25.4	+20 02.9	307 13.6	− 5 51.3	357 26.3	161	+ 9 49.7	126
19	163 08.0	144 51.8	03.5	91 05.9	03.2	102 27.3	03.0	322 16.2	51.3	12 01.4	162	9 37.1	126
20	178 10.5	159 52.9	03.7	106 06.5	03.4	117 29.1	03.1	337 18.8	51.2	26 36.6	162	9 24.5	126
21	193 12.9	174 54.1	•• 03.9	121 07.1	•• 03.7	132 31.0	•• 03.2	352 21.4	•• 51.2	41 11.8	162	• 9 11.9	127
22	208 15.4	189 55.2	04.0	136 07.8	03.9	147 32.8	03.4	7 24.0	51.2	55 47.0	163	8 59.2	127
23	223 17.9	204 56.3	04.2	151 08.4	04.1	162 34.7	03.5	22 26.5	51.1	70 22.3	163	8 46.5	127
21 0	238 20.3	219 57.4	+ 7 04.4	166 09.0	+23 04.4	177 36.5	+20 03.6	37 29.1	− 5 51.1	84 57.6	164	+ 8 33.8	128
1	253 22.8	234 58.5	04.5	181 09.6	04.6	192 38.4	03.7	52 31.7	51.0	99 33.0	164	8 21.0	127
2	268 25.3	249 59.7	04.7	196 10.3	04.8	207 40.2	03.8	67 34.3	51.0	114 08.4	164	8 08.3	128
3	283 27.7	265 00.8	•• 04.9	211 10.9	•• 05.0	222 42.1	•• 03.9	82 36.9	•• 51.0	128 43.8	165	• 7 55.5	129
4	298 30.2	280 01.9	05.1	226 11.5	05.3	237 43.9	04.1	97 39.5	50.9	143 19.3	165	7 42.6	128
5	313 32.7	295 03.0	05.2	241 12.1	05.5	252 45.8	04.2	112 42.1	50.9	157 54.8	165	7 29.8	129
6	328 35.1	310 04.1	+ 7 05.4	256 12.7	+23 05.7	267 47.6	+20 04.3	127 44.7	− 5 50.8	172 30.3	166	+ 7 16.9	129
7	343 37.6	325 05.2	05.6	271 13.4	05.9	282 49.5	04.4	142 47.2	50.8	187 05.9	166	7 04.0	129
8	358 40.0	340 06.3	05.8	286 14.0	06.2	297 51.3	04.5	157 49.8	50.8	201 41.5	166	6 51.1	130
9	13 42.5	355 07.4	•• 05.9	301 14.6	•• 06.4	312 53.2	•• 04.7	172 52.4	•• 50.7	216 17.1	167	• 6 38.1	129
10	28 45.0	10 08.5	06.1	316 15.2	06.6	327 55.0	04.8	187 55.0	50.7	230 52.8	167	6 25.2	130
11	43 47.4	25 09.6	06.3	331 15.8	06.8	342 56.9	04.9	202 57.6	50.6	245 28.5	167	6 12.2	130
12	58 49.9	40 10.7	+ 7 06.5	346 16.5	+23 07.1	357 58.7	+20 05.0	218 00.2	− 5 50.6	260 04.2	167	+ 5 59.2	131
13	73 52.4	55 11.8	06.7	1 17.1	07.3	13 00.6	05.1	233 02.8	50.5	274 39.9	168	5 46.1	130
14	88 54.8	70 12.9	06.9	16 17.7	07.5	28 02.4	05.2	248 05.3	50.5	289 15.7	167	5 33.1	131
15	103 57.3	85 13.9	•• 07.1	31 18.3	•• 07.7	43 04.3	•• 05.4	263 07.9	•• 50.5	303 51.4	168	• 5 20.0	131
16	118 59.8	100 15.0	07.2	46 18.9	08.0	58 06.2	05.5	278 10.5	50.4	318 27.2	169	5 06.9	131
17	134 02.2	115 16.1	07.4	61 19.6	08.2	73 08.0	05.6	293 13.1	50.4	333 03.1	168	4 53.8	131
18	149 04.7	130 17.2	+ 7 07.6	76 20.2	+23 08.4	88 09.9	+20 05.7	308 15.7	− 5 50.3	347 38.9	168	+ 4 40.7	131
19	164 07.2	145 18.3	07.8	91 20.8	08.6	103 11.7	05.8	323 18.3	50.3	2 14.7	169	4 27.6	132
20	179 09.6	160 19.3	08.0	106 21.4	08.8	118 13.6	05.9	338 20.9	50.3	16 50.6	169	4 14.4	132
21	194 12.1	175 20.4	•• 08.2	121 22.0	•• 09.1	133 15.4	•• 06.1	353 23.4	•• 50.2	31 26.5	169	• 4 01.2	131
22	209 14.5	190 21.5	08.4	136 22.7	09.3	148 17.3	06.2	8 26.0	50.2	46 02.4	169	3 48.1	132
23	224 17.0	205 22.6	08.6	151 23.3	09.5	163 19.1	06.3	23 28.6	50.2	60 38.3	170	3 34.9	132
24	239 19.5	220 23.6	+ 7 08.8	166 23.9	+23 09.7	178 21.0	+20 06.4	38 31.2	− 5 50.1	75 14.3	169	+ 3 21.7	133
code	−	+ 11	+ 2	+ 6	+ 2	+ 19	+ 1	+ 26	+ 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
19 0	180 55.0	+19 39.4
1	195 55.0	40.0
2	210 55.0	40.5
3	225 55.0	41.1
4	240 54.9	41.6
5	255 54.9	42.2
6	270 54.9	+19 42.7
7	285 54.8	43.2
8	300 54.8	43.8
9	315 54.8	44.3
10	330 54.8	44.9
11	345 54.7	45.4
12	0 54.7	+19 45.9
13	15 54.7	46.5
14	30 54.6	47.0
15	45 54.6	47.5
16	60 54.6	48.1
17	75 54.6	48.6
18	90 54.5	+19 49.1
19	105 54.5	49.7
20	120 54.5	50.2
21	135 54.4	50.7
22	150 54.4	51.3
23	165 54.4	51.8
20 0	180 54.3	+19 52.3
1	195 54.3	52.8
2	210 54.3	53.4
3	225 54.2	53.9
4	240 54.2	54.4
5	255 54.2	55.0
6	270 54.1	+19 55.5
7	285 54.1	56.0
8	300 54.1	56.5
9	315 54.0	57.1
10	330 54.0	57.6
11	345 54.0	58.1
12	0 53.9	+19 58.6
13	15 53.9	59.1
14	30 53.9	19 59.7
15	45 53.8	+20 00.2
16	60 53.8	00.7
17	75 53.8	01.2
18	90 53.7	+20 01.7
19	105 53.7	02.3
20	120 53.7	02.8
21	135 53.6	03.3
22	150 53.6	03.8
23	165 53.6	04.3
21 0	180 53.5	+20 04.8
1	195 53.5	05.4
2	210 53.4	05.9
3	225 53.4	06.4
4	240 53.4	06.9
5	255 53.3	07.4
6	270 53.3	+20 07.9
7	285 53.3	08.4
8	300 53.2	08.9
9	315 53.2	09.4
10	330 53.1	10.0
11	345 53.1	10.5
12	0 53.1	+20 11.0
13	15 53.0	11.5
14	30 53.0	12.0
15	45 52.9	12.5
16	60 52.9	13.0
17	75 52.9	13.5
18	90 52.8	+20 14.0
19	105 52.8	14.5
20	120 52.7	15.0
21	135 52.7	15.5
22	150 52.6	16.0
23	165 52.6	16.5
24	180 52.6	+20 17.0
code	—	+ 5

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.3
5	Achernar	336 00.5	−57 28.1
30	Acrux	173 59.6	−62 50.8
19	Adhara	255 48.3	−28 54.6
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.6	+56 12.8
34	Alkaid	153 33.8	+49 32.7
55	Al Na'ir	28 40.1	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.4	− 8 27.5
41	Alphecca	126 48.8	+26 52.1
1	Alpheratz	358 30.5	+28 49.9
51	Altair	62 52.0	+ 8 44.5
2	Ankaa	354 00.2	−42 33.3
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.1	−68 56.8
22	Avior	234 36.9	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.0
17	Canopus	264 16.6	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.1	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.3	−18 14.4
27	Dubhe	194 46.4	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.4
54	Enif	34 31.4	+ 9 39.5
56	Fomalhaut	16 13.6	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.2
6	Hamal	328 52.0	+23 14.6
48	Kaus Aust.	84 43.2	−34 24.6
40	Kochab	137 16.3	+74 20.7
57	Markab	14 23.4	+14 57.2
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 49.9	−69 31.8
9	Mirfak	309 45.6	+49 41.9
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.7
46	R'alhague	96 48.0	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.6	+56 16.8
45	Shaula	97 22.8	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.9
49	Vega	81 09.2	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 19	20	21
h	m s	m s	m s
0	+ 3 40.2	+ 3 37.4	+ 3 34.1
6	+ 3 39.5	+ 3 36.7	+ 3 33.2
12	+ 3 38.9	+ 3 35.8	+ 3 32.3
18	+ 3 38.2	+ 3 35.0	+ 3 31.3
24	+ 3 37.4	+ 3 34.1	+ 3 30.3

Lat.	Sunrise	Twlt. begins	Moonrise 19	20	21	22
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	6 40	9 20	11 23	13 16
70	▭	▭	7 32	9 41	11 32	13 17
68	1 18	////	8 04	9 57	11 39	13 17
66	2 03	////	8 27	10 10	11 45	13 17
64	2 32	////	8 46	10 21	11 50	13 18
62	2 54	////	9 00	10 30	11 55	13 18
60	3 12	////	9 13	10 37	11 59	13 18
58	3 26	////	9 24	10 44	12 02	13 18
56	3 39	////	9 33	10 50	12 05	13 19
54	3 50	////	9 41	10 55	12 08	13 19
52	3 59	0 16	9 48	11 00	12 10	13 19
50	4 08	1 15	9 55	11 04	12 12	13 19
45	4 26	2 14	10 09	11 14	12 17	13 19
40	4 41	2 49	10 20	11 21	12 21	13 19
35	4 53	3 14	10 30	11 28	12 24	13 20
30	5 04	3 32	10 39	11 34	12 27	13 20
20	5 22	4 02	10 53	11 44	12 32	13 20
10	5 38	4 23	11 06	11 53	12 37	13 21
0	5 53	4 40	11 18	12 01	12 41	13 21
10	6 07	4 53	11 30	12 09	12 46	13 21
20	6 23	5 06	11 43	12 17	12 50	13 21
30	6 40	5 17	11 57	12 27	12 55	13 22
35	6 51	5 22	12 05	12 33	12 58	13 22
40	7 02	5 26	12 15	12 39	13 01	13 22
45	7 16	5 32	12 26	12 47	13 05	13 23
50	7 33	5 37	12 39	12 55	13 10	13 23
52	7 41	5 39	12 45	13 00	13 12	13 23
54	7 49	5 42	12 52	13 04	13 14	13 23
56	7 59	5 43	12 59	13 09	13 17	13 24
58	8 10	5 45	13 08	13 14	13 19	13 24
60	8 23	5 48	13 18	13 21	13 23	13 24
S						

Lat.	Sunset	Twlt. ends	Moonset 19	20	21	22
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	3 53	2 43	2 06	1 38
70	▭	▭	2 59	2 20	1 55	1 34
68	22 41	////	2 26	2 03	1 46	1 31
66	21 54	////	2 01	1 48	1 38	1 28
64	21 23	////	1 42	1 36	1 31	1 26
62	21 01	////	1 26	1 26	1 25	1 24
60	20 43	////	1 13	1 17	1 20	1 22
58	20 28	////	1 02	1 10	1 16	1 20
56	20 15	////	0 52	1 03	1 11	1 19
54	20 04	////	0 43	0 57	1 08	1 17
52	19 55	////	0 35	0 51	1 05	1 16
50	19 46	22 42	0 28	0 46	1 02	1 15
45	19 28	21 42	0 12	0 35	0 55	1 13
40	19 13	21 06	0 00	0 26	0 50	1 11
35	19 00	20 41	24 18	0 18	0 45	1 09
30	18 49	20 21	24 11	0 11	0 40	1 08
20	18 31	19 52	24 00	0 00	0 33	1 05
10	18 15	19 31	23 49	24 27	0 27	1 03
0	18 00	19 13	23 39	24 20	0 20	1 00
10	17 45	18 59	23 29	24 14	0 14	0 58
20	17 30	18 47	23 18	24 08	0 08	0 56
30	17 12	18 35	23 06	24 00	0 00	0 53
35	17 02	18 30	22 58	23 55	24 51	0 51
40	16 50	18 25	22 50	23 50	24 49	0 49
45	16 36	18 19	22 40	23 44	24 47	0 47
50	16 19	18 14	22 29	23 37	24 44	0 44
52	16 12	18 12	22 23	23 34	24 43	0 43
54	16 03	18 10	22 17	23 30	24 42	0 42
56	15 53	18 07	22 10	23 26	24 40	0 40
58	15 42	18 05	22 02	23 22	24 39	0 39
60	15 29	18 02	21 54	23 17	24 37	0 37
S						

GMT of Transit Meridian of Greenwich DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
19	17 29	9 23	12 57	12 14	21 35
20	18 11	9 21	12 56	12 11	21 31
21	18 51	9 20	12 55	12 08	21 26
22	19 30	9 18	12 54	12 05	21 22

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0			
30	0.1	0.3	0.1
45	0.1	0.3	0.0
60	0.1	0.2	0.0
75	0.1	0.1	0.0
90	0.1	0.0	0.0

Moon's Lower Limb Add

Alt.	19	20	21
°	′	′	′
0	12.8	12.4	12.1
4	12.8	12.4	12.1
8	12.8	12.4	12.2
12	12.8	12.4	12.2
16	12.9	12.5	12.2
20	12.9	12.6	12.3
24	13.0	12.6	12.4
28	13.0	12.7	12.5
32	13.1	12.8	12.6
36	13.2	12.9	12.7
40	13.3	13.0	12.8
44	13.4	13.1	12.9
48	13.5	13.3	13.1
52	13.7	13.4	13.2
56	13.8	13.5	13.4
60	13.9	13.7	13.5
64	14.1	13.9	13.7
68	14.2	14.0	13.9
72	14.3	14.2	14.1
76	14.5	14.4	14.3
80	14.6	14.5	14.4
84	14.8	14.7	14.6
88	14.9	14.8	14.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	19	20	21
°	′	′	′
0	17.2	17.4	17.5
4	17.1	17.4	17.5
8	17.1	17.3	17.5
12	17.1	17.3	17.4
16	17.0	17.2	17.4
20	17.0	17.2	17.3
24	16.9	17.1	17.2
28	16.9	17.0	17.2
32	16.8	16.9	17.1
36	16.7	16.8	16.9
40	16.6	16.7	16.8
44	16.5	16.6	16.7
48	16.4	16.5	16.6
52	16.2	16.3	16.4
56	16.1	16.2	16.2
60	16.0	16.0	16.1
64	15.8	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.2	15.2
84	15.1	15.0	15.0
88	15.0	14.9	14.9
90			

Subtract from table, back cover

Hebrew Pentecost (Shebuoth)	20
First Quarter	20

918768°—52——7

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
22 0	239 19.5	220 23.6	+ 7 08.8	166 23.9	+23 09.7	178 21.0	+20 06.4	38 31.2	− 5 50.1	75 14.3	169	+ 3 21.7	−133
1	254 21.9	235 24.7	09.0	181 24.5	09.9	193 22.8	06.5	53 33.8	50.1	89 50.2	170	3 08.4	−132
2	269 24.4	250 25.8	09.2	196 25.1	10.2	208 24.7	06.6	68 36.4	50.0	104 26.2	169	2 55.2	−132
3	284 26.9	265 26.8	09.4	211 25.8	10.4	223 26.5	06.8	83 38.9	50.0	119 02.1	170	2 42.0	−133
4	299 29.3	280 27.9	09.6	226 26.4	10.6	238 28.4	06.9	98 41.5	50.0	133 38.1	170	2 28.7	−132
5	314 31.8	295 28.9	09.8	241 27.0	10.8	253 30.2	07.0	113 44.1	49.9	148 14.1	169	2 15.5	−133
6	329 34.3	310 30.0	+ 7 10.0	256 27.6	+23 11.0	268 32.1	+20 07.1	128 46.7	− 5 49.9	162 50.0	170	+ 2 02.2	−133
7	344 36.7	325 31.0	10.2	271 28.2	11.2	283 33.9	07.2	143 49.3	49.8	177 26.0	170	1 48.9	−133
8	359 39.2	340 32.1	10.4	286 28.9	11.5	298 35.8	07.3	158 51.9	49.8	192 02.0	170	1 35.6	−133
9	14 41.7	355 33.1	10.7	301 29.5	11.7	313 37.6	07.5	173 54.4	49.8	206 38.0	170	1 22.3	−133
10	29 44.1	10 34.2	10.9	316 30.1	11.9	328 39.5	07.6	188 57.0	49.7	221 14.0	170	1 09.0	−133
11	44 46.6	25 35.2	11.1	331 30.7	12.1	343 41.3	07.7	203 59.6	49.7	235 50.0	170	0 55.7	−133
12	59 49.0	40 36.3	+ 7 11.3	346 31.3	+23 12.3	358 43.2	+20 07.8	219 02.2	− 5 49.6	250 26.0	170	+ 0 42.4	−133
13	74 51.5	55 37.3	11.5	1 32.0	12.5	13 45.0	07.9	234 04.8	49.6	265 02.0	170	0 29.1	−133
14	89 54.0	70 38.4	11.7	16 32.6	12.8	28 46.9	08.0	249 07.4	49.6	279 38.0	170	0 15.8	−133
15	104 56.4	85 39.4	11.9	31 33.2	13.0	43 48.7	08.2	264 09.9	49.5	294 14.0	170	+ 0 02.5	−133
16	119 58.9	100 40.4	12.2	46 33.8	13.2	58 50.6	08.3	279 12.5	49.5	308 50.0	169	− 0 10.8	−134
17	135 01.4	115 41.5	12.4	61 34.4	13.4	73 52.4	08.4	294 15.1	49.4	323 25.9	170	0 24.2	−133
18	150 03.8	130 42.5	+ 7 12.6	76 35.1	+23 13.6	88 54.3	+20 08.5	309 17.7	− 5 49.4	338 01.9	170	− 0 37.5	−133
19	165 06.3	145 43.5	12.8	91 35.7	13.8	103 56.1	08.6	324 20.3	49.4	352 37.9	169	0 50.8	−134
20	180 08.8	160 44.6	13.1	106 36.3	14.0	118 58.0	08.7	339 22.9	49.3	7 13.8	170	1 04.2	−133
21	195 11.2	175 45.6	13.3	121 36.9	14.2	133 59.8	08.9	354 25.4	49.3	21 49.8	169	1 17.5	−133
22	210 13.7	190 46.6	13.5	136 37.5	14.5	149 01.7	09.0	9 28.0	49.3	36 25.7	169	1 30.8	−133
23	225 16.1	205 47.6	13.7	151 38.2	14.7	164 03.5	09.1	24 30.6	49.2	51 01.6	169	1 44.1	−133
23 0	240 18.6	220 48.7	+ 7 14.0	166 38.8	+23 14.9	179 05.4	+20 09.2	39 33.2	− 5 49.2	65 37.5	169	− 1 57.4	−134
1	255 21.1	235 49.7	14.2	181 39.4	15.1	194 07.2	09.3	54 35.8	49.1	80 13.4	169	2 10.8	−133
2	270 23.5	250 50.7	14.4	196 40.0	15.3	209 09.1	09.4	69 38.3	49.1	94 49.3	168	2 24.1	−133
3	285 26.0	265 51.7	14.7	211 40.6	15.5	224 10.9	09.5	84 40.9	49.1	109 25.1	169	2 37.4	−133
4	300 28.5	280 52.7	14.9	226 41.3	15.7	239 12.8	09.7	99 43.5	49.0	124 01.0	168	2 50.7	−133
5	315 30.9	295 53.7	15.1	241 41.9	15.9	254 14.6	09.8	114 46.1	49.0	138 36.8	168	3 04.0	−133
6	330 33.4	310 54.7	+ 7 15.4	256 42.5	+23 16.1	269 16.5	+20 09.9	129 48.7	− 5 49.0	153 12.6	168	− 3 17.3	−133
7	345 35.9	325 55.8	15.6	271 43.1	16.3	284 18.3	10.0	144 51.2	48.9	167 48.4	167	3 30.6	−132
8	0 38.3	340 56.8	15.8	286 43.7	16.6	299 20.2	10.1	159 53.8	48.9	182 24.1	168	3 43.8	−133
9	15 40.8	355 57.8	16.1	301 44.3	16.8	314 22.1	10.2	174 56.4	48.8	196 59.9	167	3 57.1	−133
10	30 43.3	10 58.8	16.3	316 45.0	17.0	329 23.9	10.4	189 59.0	48.8	211 35.6	167	4 10.4	−132
11	45 45.7	25 59.8	16.6	331 45.6	17.2	344 25.8	10.5	205 01.6	48.8	226 11.3	166	4 23.6	−132
12	60 48.2	41 00.8	+ 7 16.8	346 46.2	+23 17.4	359 27.6	+20 10.6	220 04.1	− 5 48.7	240 46.9	166	− 4 36.8	−133
13	75 50.6	56 01.8	17.1	1 46.8	17.6	14 29.5	10.7	235 06.7	48.7	255 22.5	166	4 50.1	−132
14	90 53.1	71 02.7	17.3	16 47.4	17.8	29 31.3	10.8	250 09.3	48.7	269 58.1	166	5 03.3	−132
15	105 55.6	86 03.7	17.6	31 48.1	18.0	44 33.2	10.9	265 11.9	48.6	284 33.7	165	5 16.5	−132
16	120 58.0	101 04.7	17.8	46 48.7	18.2	59 35.0	11.0	280 14.5	48.6	299 09.2	165	5 29.7	−131
17	136 00.5	116 05.7	18.1	61 49.3	18.4	74 36.9	11.2	295 17.0	48.5	313 44.7	165	5 42.8	−132
18	151 03.0	131 06.7	+ 7 18.3	76 49.9	+23 18.6	89 38.7	+20 11.3	310 19.6	− 5 48.5	328 20.2	164	− 5 56.0	−131
19	166 05.4	146 07.7	18.6	91 50.5	18.8	104 40.6	11.4	325 22.2	48.5	342 55.6	164	6 09.1	−132
20	181 07.9	161 08.7	18.8	106 51.2	19.0	119 42.4	11.5	340 24.8	48.4	357 31.0	164	6 22.3	−131
21	196 10.4	176 09.7	19.1	121 51.8	19.2	134 44.3	11.6	355 27.4	48.4	12 06.4	163	6 35.4	−131
22	211 12.8	191 10.6	19.3	136 52.4	19.4	149 46.1	11.7	10 29.9	48.4	26 41.7	163	6 48.5	−130
23	226 15.3	206 11.6	19.6	151 53.0	19.6	164 48.0	11.9	25 32.5	48.3	41 17.0	163	7 01.5	−131
24 0	241 17.8	221 12.6	+ 7 19.8	166 53.6	+23 19.8	179 49.8	+20 12.0	40 35.1	− 5 48.3	55 52.3	162	− 7 14.6	−130
1	256 20.2	236 13.6	20.1	181 54.3	20.0	194 51.7	12.1	55 37.7	48.2	70 27.5	161	7 27.6	−130
2	271 22.7	251 14.5	20.4	196 54.9	20.2	209 53.5	12.2	70 40.3	48.2	85 02.6	162	7 40.6	−130
3	286 25.1	266 15.5	20.6	211 55.5	20.4	224 55.4	12.3	85 42.8	48.2	99 37.8	161	7 53.6	−130
4	301 27.6	281 16.5	20.9	226 56.1	20.6	239 57.2	12.4	100 45.4	48.1	114 12.9	160	8 06.6	−129
5	316 30.1	296 17.4	21.2	241 56.7	20.8	254 59.1	12.5	115 48.0	48.1	128 47.9	160	8 19.5	−129
6	331 32.5	311 18.4	+ 7 21.4	256 57.4	+23 21.0	270 00.9	+20 12.7	130 50.6	− 5 48.1	143 22.9	159	− 8 32.4	−129
7	346 35.0	326 19.4	21.7	271 58.0	21.2	285 02.8	12.8	145 53.1	48.0	157 57.8	159	8 45.3	−129
8	1 37.5	341 20.3	22.0	286 58.6	21.4	300 04.6	12.9	160 55.7	48.0	172 32.7	158	8 58.2	−128
9	16 39.9	356 21.3	22.2	301 59.2	21.6	315 06.5	13.0	175 58.3	48.0	187 07.5	158	9 11.0	−129
10	31 42.4	11 22.2	22.5	316 59.8	21.8	330 08.3	13.1	191 00.9	47.9	201 42.3	158	9 23.9	−127
11	46 44.9	26 23.2	22.8	332 00.4	22.0	345 10.2	13.2	206 03.4	47.9	216 17.1	157	9 36.6	−128
12	61 47.3	41 24.1	+ 7 23.0	347 01.1	+23 22.2	0 12.0	+20 13.3	221 06.0	− 5 47.8	230 51.8	156	− 9 49.4	−127
13	76 49.8	56 25.1	23.3	2 01.7	22.4	15 13.9	13.5	236 08.6	47.8	245 26.4	156	10 02.1	−127
14	91 52.2	71 26.0	23.6	17 02.3	22.6	30 15.7	13.6	251 11.2	47.8	260 01.0	155	10 14.8	−127
15	106 54.7	86 27.0	23.9	32 02.9	22.8	45 17.6	13.7	266 13.8	47.7	274 35.5	155	10 27.5	−126
16	121 57.2	101 27.9	24.1	47 03.5	23.0	60 19.4	13.8	281 16.3	47.7	289 10.0	154	10 40.1	−126
17	136 59.6	116 28.9	24.4	62 04.2	23.2	75 21.3	13.9	296 18.9	47.7	303 44.4	154	10 52.7	−126
18	152 02.1	131 29.8	+ 7 24.7	77 04.8	+23 23.4	90 23.1	+20 14.0	311 21.5	− 5 47.6	318 18.8	153	−11 05.3	−125
19	167 04.6	146 30.7	25.0	92 05.4	23.6	105 25.0	14.1	326 24.1	47.6	332 53.1	152	11 17.8	−125
20	182 07.0	161 31.7	25.3	107 06.0	23.8	120 26.8	14.3	341 26.6	47.6	347 27.3	152	11 30.3	−124
21	197 09.5	176 32.6	25.5	122 06.6	24.0	135 28.7	14.4	356 29.2	47.5	2 01.5	151	−11 42.7	−125
22	212 12.0	191 33.6	25.8	137 07.3	24.2	150 30.5	14.5	11 31.8	47.5	16 35.6	150	11 55.2	−123
23	227 14.4	206 34.5	26.1	152 07.9	24.4	165 32.4	14.6	26 34.4	47.5	31 09.6	150	12 07.5	−124
24	242 16.9	221 35.4	+ 7 26.4	167 08.5	+23 24.6	180 34.2	+20 14.7	41 36.9	− 5 47.4	45 43.6	149	−12 19.9	−123
code	−	+ 10	+ 3	+ 6	+ 2	+ 19	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
22 0	180 52.6	+20 17.0
1	195 52.5	17.5
2	210 52.5	18.0
3	225 52.4	18.5
4	240 52.4	19.0
5	255 52.3	19.5
6	270 52.3	+20 20.0
7	285 52.3	20.5
8	300 52.2	21.0
9	315 52.2	21.5
10	330 52.1	22.0
11	345 52.1	22.5
12	0 52.0	+20 23.0
13	15 52.0	23.5
14	30 51.9	24.0
15	45 51.9	24.5
16	60 51.9	25.0
17	75 51.8	25.4
18	90 51.8	+20 25.9
19	105 51.7	26.4
20	120 51.7	26.9
21	135 51.6	27.4
22	150 51.6	27.9
23	165 51.5	28.4
23 0	180 51.5	+20 28.9
1	195 51.4	29.3
2	210 51.4	29.8
3	225 51.3	30.3
4	240 51.3	30.8
5	255 51.2	31.3
6	270 51.2	+20 31.8
7	285 51.1	32.2
8	300 51.1	32.7
9	315 51.0	33.2
10	330 51.0	33.7
11	345 50.9	34.2
12	0 50.9	+20 34.6
13	15 50.8	35.1
14	30 50.8	35.6
15	45 50.7	36.1
16	60 50.7	36.6
17	75 50.6	37.0
18	90 50.6	+20 37.5
19	105 50.5	38.0
20	120 50.5	38.5
21	135 50.4	38.9
22	150 50.4	39.4
23	165 50.3	39.9
24 0	180 50.3	+20 40.3
1	195 50.2	40.8
2	210 50.2	41.3
3	225 50.1	41.8
4	240 50.1	42.2
5	255 50.0	42.7
6	270 49.9	+20 43.2
7	285 49.9	43.6
8	300 49.8	44.1
9	315 49.8	44.6
10	330 49.7	45.0
11	345 49.7	45.5
12	0 49.6	+20 46.0
13	15 49.6	46.4
14	30 49.5	46.9
15	45 49.5	47.3
16	60 49.4	47.8
17	75 49.3	48.3
18	90 49.3	+20 48.7
19	105 49.2	49.2
20	120 49.2	49.6
21	135 49.1	50.1
22	150 49.1	50.6
23	165 49.0	51.0
24	180 48.9	+20 51.5
code	−	+ 5

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.3
5	Achernar	336 00.5	−57 28.1
30	Acrux	173 59.7	−62 50.8
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.6	+56 12.8
34	Alkaid	153 33.8	+49 32.7
55	Al Na'ir	28 40.1	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.5	− 8 27.5
41	Alphecca	126 48.8	+26 52.1
1	Alpheratz	358 30.4	+28 49.9
51	Altair	62 52.0	+ 8 44.5
2	Ankaa	354 00.2	−42 33.3
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.1	−68 56.8
22	Avior	234 36.9	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.3
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.1	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.2	−18 14.4
27	Dubhe	194 46.5	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.4
54	Enif	34 31.3	+ 9 39.5
56	Fomalhaut	16 13.6	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 52.0	+23 14.6
48	Kaus Aust.	84 43.2	−34 24.6
40	Kochab	137 16.4	+74 20.7
57	Markab	14 23.3	+14 57.2
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 49.9	−69 31.8
9	Mirfak	309 45.6	+49 41.8
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.7	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 48.0	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.6	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.9
49	Vega	81 09.1	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 22	23	24
h	m s	m s	m s
0	+ 3 30.3	+ 3 26.0	+ 3 21.2
6	+ 3 29.3	+ 3 24.9	+ 3 19.9
12	+ 3 28.2	+ 3 23.7	+ 3 18.6
18	+ 3 27.1	+ 3 22.4	+ 3 17.2
24	+ 3 26.0	+ 3 21.2	+ 3 15.9

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 22 h m	23 h m	24 h m	25 h m
72	▭	▭	13 16	15 10	17 13	19 51
70	▭	▭	13 17	15 02	16 53	19 03
68	0 56	////	13 17	14 55	16 38	18 33
66	1 51	////	13 17	14 50	16 26	18 10
64	2 23	////	13 18	14 46	16 16	17 53
62	2 47	////	13 18	14 42	16 08	17 39
60	3 05	////	13 18	14 38	16 00	17 26
58	3 21	////	13 18	14 35	15 54	17 16
56	3 34	////	13 19	14 33	15 48	17 07
54	3 45	////	13 19	14 30	15 43	16 59
52	3 55	////	13 19	14 28	15 39	16 52
50	4 04	1 03	13 19	14 26	15 35	16 46
45	4 23	2 08	13 19	14 22	15 26	16 32
40	4 38	2 45	13 19	14 18	15 19	16 21
35	4 51	3 11	13 20	14 15	15 12	16 11
30	5 02	3 30	13 20	14 13	15 07	16 03
20	5 21	4 01	13 20	14 08	14 57	15 49
10	5 38	4 22	13 21	14 04	14 49	15 36
0	5 53	4 40	13 21	14 01	14 42	15 25
10	6 08	4 54	13 21	13 57	14 34	15 13
20	6 24	5 07	13 21	13 53	14 26	15 01
30	6 42	5 18	13 22	13 49	14 17	14 48
35	6 53	5 23	13 22	13 46	14 12	14 40
40	7 05	5 29	13 22	13 43	14 06	14 31
45	7 19	5 34	13 23	13 40	13 59	14 20
50	7 37	5 40	13 23	13 36	13 51	14 08
52	7 45	5 43	13 23	13 35	13 47	14 02
54	7 54	5 46	13 23	13 33	13 43	13 55
56	8 04	5 48	13 24	13 31	13 38	13 48
58	8 16	5 50	13 24	13 28	13 33	13 40
60	8 30	5 53	13 24	13 26	13 28	13 31
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 22 h m	23 h m	24 h m	25 h m
72	▭	▭	1 38	1 11	0 42	{0 06 / 23 00}
70	▭	▭	1 34	1 14	0 53	{0 27 / 23 49}
68	23 06	////	1 31	1 16	1 02	0 44
66	22 06	////	1 28	1 18	1 09	0 58
64	21 33	////	1 26	1 20	1 15	1 09
62	21 09	////	1 24	1 22	1 20	1 19
60	20 50	////	1 22	1 23	1 25	1 27
58	20 34	////	1 20	1 24	1 29	1 35
56	20 21	////	1 19	1 26	1 33	1 41
54	20 09	////	1 17	1 27	1 36	1 47
52	19 59	////	1 16	1 28	1 39	1 53
50	19 50	22 55	1 15	1 28	1 42	1 57
45	19 31	21 47	1 13	1 30	1 48	2 08
40	19 15	21 10	1 11	1 32	1 53	2 17
35	19 02	20 44	1 09	1 33	1 58	2 24
30	18 51	20 24	1 08	1 34	2 02	2 31
20	18 32	19 54	1 05	1 36	2 08	2 42
10	18 16	19 32	1 03	1 38	2 14	2 52
0	18 00	19 14	1 00	1 40	2 20	3 02
10	17 45	18 59	0 58	1 42	2 26	3 12
20	17 29	18 46	0 56	1 43	2 32	3 22
30	17 11	18 35	0 53	1 45	2 39	3 34
35	17 00	18 29	0 51	1 46	2 43	3 41
40	16 48	18 23	0 49	1 48	2 47	3 48
45	16 34	18 18	0 47	1 49	2 53	3 57
50	16 16	18 11	0 44	1 51	2 59	4 09
52	16 08	18 09	0 43	1 52	3 02	4 14
54	15 59	18 07	0 42	1 53	3 05	4 19
56	15 48	18 03	0 40	1 54	3 09	4 26
58	15 37	18 02	0 39	1 55	3 13	4 33
60	15 23	17 58	0 37	1 56	3 17	4 41
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
22	19 30	9 18	12 54	12 05	21 22
23	20 10	9 16	12 53	12 02	21 18
24	20 52	9 15	12 52	11 59	21 14
25	21 36	9 13	12 51	11 56	21 10

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.3	0.1
30	0.1	0.2	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	22	23	24
°	′	′	′
0	12.0	12.2	12.6
4	12.0	12.3	12.6
8	12.0	12.3	12.7
12	12.1	12.3	12.7
16	12.1	12.4	12.7
20	12.2	12.4	12.8
24	12.3	12.5	12.9
28	12.4	12.6	12.9
32	12.5	12.7	13.0
36	12.6	12.8	13.1
40	12.7	12.9	13.2
44	12.8	13.0	13.3
48	13.0	13.2	13.4
52	13.1	13.3	13.6
56	13.3	13.5	13.7
60	13.5	13.6	13.8
64	13.6	13.8	14.0
68	13.8	14.0	14.1
72	14.0	14.1	14.3
76	14.2	14.3	14.4
80	14.4	14.5	14.6
84	14.6	14.7	14.8
88	14.7	14.8	14.9
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	22	23	24
°	′	′	′
0	17.6	17.4	17.2
4	17.6	17.4	17.2
8	17.5	17.4	17.2
12	17.5	17.4	17.2
16	17.5	17.3	17.1
20	17.4	17.3	17.1
24	17.3	17.2	17.0
28	17.2	17.1	16.9
32	17.1	17.0	16.8
36	17.0	16.9	16.7
40	16.9	16.8	16.6
44	16.7	16.6	16.5
48	16.6	16.5	16.4
52	16.4	16.4	16.3
56	16.3	16.2	16.1
60	16.1	16.1	16.0
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.1
88	14.8	14.9	15.0
90			

Subtract from table, back cover

Pentecost (Whit Sunday) 24

GMT	♈ GHA	VENUS −4.2 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
25 0	242 16.9	221 35.4	+ 7 26.4	167 08.5	+23 24.6	180 34.2	+20 14.7	41 36.9	− 5 47.4	45 43.6	149	−12 19.9	−123
1	257 19.4	236 36.3	26.7	182 09.1	24.8	195 36.1	14.8	56 39.5	47.4	60 17.5	149	12 32.2	−122
2	272 21.8	251 37.3	27.0	197 09.7	25.0	210 37.9	14.9	71 42.1	47.3	74 51.4	148	12 44.4	−122
3	287 24.3	266 38.2	•• 27.3	212 10.4	•• 25.2	225 39.8	•• 15.1	86 44.7	•• 47.3	89 25.2	147	•12 56.6	−122
4	302 26.7	281 39.1	27.6	227 11.0	25.3	240 41.6	15.2	101 47.2	47.3	103 58.9	146	13 08.8	−121
5	317 29.2	296 40.0	27.9	242 11.6	25.5	255 43.5	15.3	116 49.8	47.2	118 32.5	146	13 20.9	−121
6	332 31.7	311 41.0	+ 7 28.1	257 12.2	+23 25.7	270 45.3	+20 15.4	131 52.4	− 5 47.2	133 06.1	145	−13 33.0	−120
7	347 34.1	326 41.9	28.4	272 12.8	25.9	285 47.2	15.5	146 55.0	47.2	147 39.6	144	13 45.0	−120
8	2 36.6	341 42.8	28.7	287 13.4	26.1	300 49.0	15.6	161 57.5	47.1	162 13.0	144	13 57.0	−119
9	17 39.1	356 43.7	•• 29.0	302 14.1	•• 26.3	315 50.9	•• 15.7	177 00.1	•• 47.1	176 46.4	143	•14 08.9	−119
10	32 41.5	11 44.6	29.3	317 14.7	26.5	330 52.7	15.9	192 02.7	47.1	191 19.7	142	14 20.8	−119
11	47 44.0	26 45.5	29.6	332 15.3	26.7	345 54.6	16.0	207 05.3	47.0	205 52.9	142	14 32.7	−118
12	62 46.5	41 46.4	+ 7 29.9	347 15.9	+23 26.9	0 56.4	+20 16.1	222 07.8	− 5 47.0	220 26.1	140	−14 44.5	−117
13	77 48.9	56 47.4	30.2	2 16.5	27.1	15 58.3	16.2	237 10.4	47.0	234 59.1	140	14 56.2	−117
14	92 51.4	71 48.3	30.5	17 17.2	27.2	31 00.1	16.3	252 13.0	46.9	249 32.1	139	15 07.9	−116
15	107 53.9	86 49.2	•• 30.8	32 17.8	•• 27.4	46 02.0	•• 16.4	267 15.6	•• 46.9	264 05.0	139	•15 19.5	−115
16	122 56.3	101 50.1	31.1	47 18.4	27.6	61 03.8	16.5	282 18.1	46.9	278 37.9	137	15 31.0	−116
17	137 58.8	116 51.0	31.4	62 19.0	27.8	76 05.7	16.7	297 20.7	46.8	293 10.6	137	15 42.6	−114
18	153 01.2	131 51.9	+ 7 31.8	77 19.6	+23 28.0	91 07.5	+20 16.8	312 23.3	− 5 46.8	307 43.3	136	−15 54.0	−114
19	168 03.7	146 52.8	32.1	92 20.3	28.2	106 09.4	16.9	327 25.8	46.8	322 15.9	135	16 05.4	−113
20	183 06.2	161 53.7	32.4	107 20.9	28.4	121 11.2	17.0	342 28.4	46.7	336 48.4	134	16 16.7	−113
21	198 08.6	176 54.5	•• 32.7	122 21.5	•• 28.6	136 13.1	•• 17.1	357 31.0	•• 46.7	351 20.8	133	•16 28.0	−112
22	213 11.1	191 55.4	33.0	137 22.1	28.7	151 14.9	17.2	12 33.6	46.7	5 53.1	133	16 39.2	−111
23	228 13.6	206 56.3	33.3	152 22.7	28.9	166 16.8	17.3	27 36.1	46.6	20 25.4	132	16 50.3	−111
26 0	243 16.0	221 57.2	+ 7 33.6	167 23.3	+23 29.1	181 18.6	+20 17.4	42 38.7	− 5 46.6	34 57.6	131	−17 01.4	−110
1	258 18.5	236 58.1	33.9	182 24.0	29.3	196 20.5	17.6	57 41.3	46.6	49 29.7	130	17 12.4	−110
2	273 21.0	251 59.0	34.3	197 24.6	29.5	211 22.3	17.7	72 43.8	46.5	64 01.7	129	17 23.4	−109
3	288 23.4	266 59.9	•• 34.6	212 25.2	•• 29.7	226 24.2	•• 17.8	87 46.4	•• 46.5	78 33.6	128	•17 34.3	−108
4	303 25.9	282 00.8	34.9	227 25.8	29.8	241 26.0	17.9	102 49.0	46.4	93 05.4	128	17 45.1	−107
5	318 28.3	297 01.6	35.2	242 26.4	30.0	256 27.9	18.0	117 51.6	46.4	107 37.2	126	17 55.8	−107
6	333 30.8	312 02.5	+ 7 35.5	257 27.1	+23 30.2	271 29.7	+20 18.1	132 54.1	− 5 46.4	122 08.8	126	−18 06.5	−106
7	348 33.3	327 03.4	35.8	272 27.7	30.4	286 31.6	18.2	147 56.7	46.3	136 40.4	125	18 17.1	−105
8	3 35.7	342 04.3	36.2	287 28.3	30.6	301 33.4	18.3	162 59.3	46.3	151 11.9	124	18 27.6	−104
9	18 38.2	357 05.1	•• 36.5	302 28.9	•• 30.7	316 35.3	•• 18.5	178 01.9	•• 46.3	165 43.3	123	•18 38.0	−104
10	33 40.7	12 06.0	36.8	317 29.5	30.9	331 37.1	18.6	193 04.4	46.2	180 14.6	122	18 48.4	−103
11	48 43.1	27 06.9	37.1	332 30.2	31.1	346 39.0	18.7	208 07.0	46.2	194 45.8	121	18 58.7	−102
12	63 45.6	42 07.7	+ 7 37.5	347 30.8	+23 31.3	1 40.8	+20 18.8	223 09.6	− 5 46.2	209 16.9	120	−19 08.9	−101
13	78 48.1	57 08.6	37.8	2 31.4	31.5	16 42.7	18.9	238 12.1	46.1	223 47.9	119	19 19.0	−101
14	93 50.5	72 09.5	38.1	17 32.0	31.7	31 44.5	19.0	253 14.7	46.1	238 18.8	119	19 29.1	− 99
15	108 53.0	87 10.3	•• 38.5	32 32.6	•• 31.8	46 46.4	•• 19.1	268 17.3	•• 46.1	252 49.7	117	•19 39.0	− 99
16	123 55.5	102 11.2	38.8	47 33.2	32.0	61 48.2	19.2	283 19.8	46.0	267 20.4	116	19 48.9	− 98
17	138 57.9	117 12.0	39.1	62 33.9	32.2	76 50.1	19.4	298 22.4	46.0	281 51.0	116	19 58.7	− 97
18	154 00.4	132 12.9	+ 7 39.4	77 34.5	+23 32.4	91 51.9	+20 19.5	313 25.0	− 5 46.0	296 21.6	115	−20 08.4	− 96
19	169 02.8	147 13.8	39.8	92 35.1	32.5	106 53.8	19.6	328 27.6	45.9	310 52.1	113	20 18.0	− 96
20	184 05.3	162 14.6	40.1	107 35.7	32.7	121 55.6	19.7	343 30.1	45.9	325 22.4	113	20 27.6	− 94
21	199 07.8	177 15.5	•• 40.5	122 36.3	•• 32.9	136 57.5	•• 19.8	358 32.7	•• 45.9	339 52.7	112	•20 37.0	− 94
22	214 10.2	192 16.3	40.8	137 37.0	33.1	151 59.3	19.9	13 35.3	45.9	354 22.9	110	20 46.4	− 92
23	229 12.7	207 17.2	41.1	152 37.6	33.2	167 01.2	20.0	28 37.8	45.8	8 52.9	110	20 55.6	− 92
27 0	244 15.2	222 18.0	+ 7 41.5	167 38.2	+23 33.4	182 03.0	+20 20.1	43 40.4	− 5 45.8	23 22.9	109	−21 04.8	− 90
1	259 17.6	237 18.9	41.8	182 38.8	33.6	197 04.9	20.3	58 43.0	45.8	37 52.8	108	21 13.8	− 90
2	274 20.1	252 19.7	42.1	197 39.4	33.8	212 06.7	20.4	73 45.5	45.7	52 22.6	107	21 22.8	− 89
3	289 22.6	267 20.5	•• 42.5	212 40.0	•• 34.0	227 08.6	•• 20.5	88 48.1	•• 45.7	66 52.3	106	•21 31.7	− 88
4	304 25.0	282 21.4	42.8	227 40.7	34.1	242 10.4	20.6	103 50.7	45.7	81 21.9	105	21 40.5	− 86
5	319 27.5	297 22.2	43.2	242 41.3	34.3	257 12.3	20.7	118 53.2	45.6	95 51.4	104	21 49.1	− 86
6	334 30.0	312 23.1	+ 7 43.5	257 41.9	+23 34.5	272 14.1	+20 20.8	133 55.8	− 5 45.6	110 20.8	103	−21 57.7	− 85
7	349 32.4	327 23.9	43.9	272 42.5	34.6	287 16.0	20.9	148 58.4	45.6	124 50.1	103	22 06.2	− 83
8	4 34.9	342 24.7	44.2	287 43.1	34.8	302 17.8	21.0	164 00.9	45.5	139 19.4	101	22 14.5	− 83
9	19 37.3	357 25.6	•• 44.6	302 43.8	•• 35.0	317 19.7	•• 21.2	179 03.5	•• 45.5	153 48.5	100	•22 22.8	− 81
10	34 39.8	12 26.4	44.9	317 44.4	35.2	332 21.5	21.3	194 06.1	45.5	168 17.5	99	22 30.9	− 81
11	49 42.3	27 27.2	45.3	332 45.0	35.3	347 23.4	21.4	209 08.6	45.4	182 46.4	99	22 39.0	− 79
12	64 44.7	42 28.0	+ 7 45.6	347 45.6	+23 35.5	2 25.2	+20 21.5	224 11.2	− 5 45.4	197 15.3	97	−22 46.9	− 78
13	79 47.2	57 28.9	46.0	2 46.2	35.7	17 27.1	21.6	239 13.8	45.4	211 44.0	97	22 54.7	− 77
14	94 49.7	72 29.7	46.3	17 46.9	35.8	32 28.9	21.7	254 16.4	45.3	226 12.7	95	23 02.4	− 76
15	109 52.1	87 30.5	•• 46.7	32 47.5	•• 36.0	47 30.8	•• 21.8	269 18.9	•• 45.3	240 41.2	95	•23 10.0	− 75
16	124 54.6	102 31.3	47.0	47 48.1	36.2	62 32.6	21.9	284 21.5	45.3	255 09.7	93	23 17.5	− 74
17	139 57.1	117 32.1	47.4	62 48.7	36.4	77 34.5	22.0	299 24.1	45.2	269 38.0	93	23 24.9	− 72
18	154 59.5	132 33.0	+ 7 47.7	77 49.3	+23 36.5	92 36.3	+20 22.2	314 26.6	− 5 45.2	284 06.3	92	−23 32.1	− 71
19	170 02.0	147 33.8	48.1	92 49.9	36.7	107 38.2	22.3	329 29.2	45.2	298 34.5	91	23 39.2	− 71
20	185 04.5	162 34.6	48.5	107 50.6	36.9	122 40.0	22.4	344 31.7	45.1	313 02.6	90	23 46.3	− 68
21	200 06.9	177 35.4	•• 48.8	122 51.2	•• 37.0	137 41.9	•• 22.5	359 34.3	•• 45.1	327 30.6	89	•23 53.1	− 68
22	215 09.4	192 36.2	49.2	137 51.8	37.2	152 43.7	22.6	14 36.9	45.1	341 58.5	88	23 59.9	− 66
23	230 11.8	207 37.0	49.5	152 52.4	37.4	167 45.6	22.7	29 39.4	45.1	356 26.3	87	24 06.5	− 66
24	245 14.3	222 37.8	+ 7 49.9	167 53.0	+23 37.5	182 47.4	+20 22.8	44 42.0	− 5 45.0	10 54.0	86	−24 13.1	− 63
code	−	+ 9	+ 3	+ 6	+ 2	+ 19	+ 1	+ 25	+ 1				

GMT	SUN GHA	SUN Dec.
	h ° ′	° ′
25 0	180 48.9	+20 51.5
1	195 48.9	51.9
2	210 48.8	52.4
3	225 48.8 ••	52.8
4	240 48.7	53.3
5	255 48.6	53.7
6	270 48.6	+20 54.2
7	285 48.5	54.6
8	300 48.5	55.1
9	315 48.4 ••	55.6
10	330 48.3	56.0
11	345 48.3	56.5
12	0 48.2	+20 56.9
13	15 48.2	57.3
14	30 48.1	57.8
15	45 48.0 ••	58.2
16	60 48.0	58.7
17	75 47.9	59.1
18	90 47.9	+20 59.6
19	105 47.8	21 00.0
20	120 47.7	00.5
21	135 47.7 ••	00.9
22	150 47.6	01.4
23	165 47.5	01.8
26 0	180 47.5	+21 02.2
1	195 47.4	02.7
2	210 47.4	03.1
3	225 47.3 ••	03.6
4	240 47.2	04.0
5	255 47.2	04.4
6	270 47.1	+21 04.9
7	285 47.0	05.3
8	300 47.0	05.8
9	315 46.9 ••	06.2
10	330 46.8	06.6
11	345 46.8	07.1
12	0 46.7	+21 07.5
13	15 46.6	07.9
14	30 46.6	08.4
15	45 46.5 ••	08.8
16	60 46.4	09.2
17	75 46.4	09.6
18	90 46.3	+21 10.1
19	105 46.2	10.5
20	120 46.2	10.9
21	135 46.1 ••	11.4
22	150 46.0	11.8
23	165 46.0	12.2
27 0	180 45.9	+21 12.6
1	195 45.8	13.1
2	210 45.8	13.5
3	225 45.7 ••	13.9
4	240 45.6	14.3
5	255 45.6	14.8
6	270 45.5	+21 15.2
7	285 45.4	15.6
8	300 45.4	16.0
9	315 45.3 ••	16.5
10	330 45.2	16.9
11	345 45.1	17.3
12	0 45.1	+21 17.7
13	15 45.0	18.1
14	30 44.9	18.6
15	45 44.9 ••	19.0
16	60 44.8	19.4
17	75 44.7	19.8
18	90 44.7	+21 20.2
19	105 44.6	20.6
20	120 44.5	21.0
21	135 44.4 ••	21.5
22	150 44.4	21.9
23	165 44.3	22.3
24	180 44.2	+21 22.7
code	−	+ 4

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.3
5	Achernar	336 00.5	−57 28.1
30	Acrux	173 59.7	−62 50.8
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.6	+56 12.8
34	Alkaid	153 33.8	+49 32.7
55	Al Na'ir	28 40.0	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.5	− 8 27.5
41	Alphecca	126 48.8	+26 52.1
1	Alpheratz	358 30.4	+28 49.9
51	Altair	62 52.0	+ 8 44.5
2	Ankaa	354 00.2	−42 33.3
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.3
43	Atria	109 03.1	−68 56.8
22	Avior	234 37.0	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.1	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.2	−18 14.4
27	Dubhe	194 46.5	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.4
54	Enif	34 31.3	+ 9 39.5
56	Fomalhaut	16 13.6	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 52.0	+23 14.6
48	Kaus Aust.	84 43.2	−34 24.6
40	Kochab	137 16.4	+74 20.8
57	Markab	14 23.3	+14 57.2
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.0	−69 31.8
9	Mirfak	309 45.5	+49 41.8
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.7	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.5	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.9
49	Vega	81 09.1	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 25	26	27
h	m s	m s	m s
0	+ 3 15.9	+ 3 10.1	+ 3 03.8
6	+ 3 14.5	+ 3 08.5	+ 3 02.1
12	+ 3 13.0	+ 3 07.0	+ 3 00.4
18	+ 3 11.6	+ 3 05.4	+ 2 58.7
24	+ 3 10.1	+ 3 03.8	+ 2 57.0

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 25 h m	26 h m	27 h m	28 h m
72	▭	▭	19 51	■	■	■
70	▭	▭	19 03	■	■	■
68	0 21	////	18 33	20 58	■	■
66	1 38	////	18 10	20 09	■	■
64	2 14	////	17 53	19 38	21 37	■
62	2 40	////	17 39	19 15	20 58	22 38
60	3 00	////	17 26	18 57	20 30	21 58
58	3 16	////	17 16	18 42	20 09	21 31
56	3 30	////	17 07	18 29	19 52	21 10
54	3 42	////	16 59	18 18	19 37	20 52
52	3 52	////	16 52	18 08	19 24	20 37
50	4 01	0 50	16 46	17 59	19 13	20 24
45	4 21	2 03	16 32	17 40	18 50	19 58
40	4 36	2 41	16 21	17 25	18 31	19 37
35	4 50	3 08	16 11	17 13	18 16	19 19
30	5 01	3 29	16 03	17 02	18 03	19 04
20	5 21	3 59	15 49	16 43	17 40	18 39
10	5 38	4 22	15 36	16 27	17 20	18 17
0	5 53	4 39	15 25	16 12	17 02	17 57
10	6 09	4 54	15 13	15 56	16 44	17 36
20	6 25	5 08	15 01	15 41	16 25	17 15
30	6 44	5 19	14 48	15 22	16 02	16 50
35	6 55	5 25	14 40	15 12	15 50	16 35
40	7 08	5 31	14 31	15 00	15 35	16 19
45	7 22	5 37	14 20	14 45	15 17	15 58
50	7 40	5 43	14 08	14 28	14 55	15 32
52	7 49	5 45	14 02	14 20	14 45	15 20
54	7 58	5 49	13 55	14 11	14 34	15 06
56	8 09	5 51	13 48	14 01	14 20	14 50
58	8 21	5 54	13 40	13 50	14 05	14 30
60	8 35	5 57	13 31	13 37	13 47	14 06

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 25 h m	26 h m	27 h m	28 h m
72	▭	▭	0 06 / 23 00	■	■	■
70	▭	▭	0 27 / 23 49	■	■	■
68	▭	▭	0 44	0 21 / 23 34	■	■
66	22 19	////	0 58	0 44	0 24	■
64	21 42	////	1 09	1 03	0 56	0 44
62	21 16	////	1 19	1 18	1 19	1 24
60	20 56	////	1 27	1 31	1 38	1 51
58	20 39	////	1 35	1 42	1 54	2 13
56	20 25	////	1 41	1 52	2 08	2 31
54	20 13	////	1 47	2 01	2 19	2 46
52	20 03	////	1 53	2 09	2 30	2 59
50	19 53	23 09	1 57	2 16	2 39	3 10
45	19 34	21 53	2 08	2 31	2 59	3 34
40	19 18	21 14	2 17	2 43	3 15	3 54
35	19 05	20 48	2 24	2 54	3 29	4 10
30	18 53	20 26	2 31	3 03	3 40	4 24
20	18 33	19 55	2 42	3 19	4 01	4 48
10	18 16	19 32	2 52	3 34	4 19	5 08
0	18 01	19 15	3 02	3 47	4 35	5 28
10	17 45	18 59	3 12	4 00	4 52	5 47
20	17 28	18 46	3 22	4 14	5 10	6 08
30	17 10	18 34	3 34	4 31	5 31	6 32
35	16 59	18 28	3 41	4 41	5 43	6 46
40	16 46	18 22	3 48	4 52	5 57	7 03
45	16 31	18 15	3 57	5 05	6 14	7 23
50	16 13	18 09	4 09	5 20	6 34	7 47
52	16 05	18 07	4 14	5 28	6 44	7 59
54	15 55	18 04	4 19	5 36	6 55	8 13
56	15 45	18 02	4 26	5 46	7 08	8 29
58	15 32	17 58	4 33	5 56	7 23	8 48
60	15 18	17 55	4 41	6 09	7 40	9 12

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
25	21 36	9 13	12 51	11 56	21 10
26	22 23	9 12	12 50	11 53	21 06
27	23 15	9 10	12 49	11 50	21 02
28	24 10	9 09	12 48	11 47	20 58

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.3	0.1
30	0.1	0.2	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	25	26	27
°	′	′	′
0	13.1	13.8	14.5
4	13.1	13.8	14.5
8	13.2	13.8	14.5
12	13.2	13.8	14.6
16	13.2	13.8	14.6
20	13.3	13.9	14.6
24	13.3	13.9	14.6
28	13.4	14.0	14.6
32	13.5	14.0	14.7
36	13.5	14.1	14.7
40	13.6	14.1	14.7
44	13.7	14.2	14.8
48	13.8	14.3	14.8
52	13.9	14.3	14.9
56	14.0	14.4	14.9
60	14.1	14.5	15.0
64	14.3	14.6	15.0
68	14.4	14.7	15.1
72	14.5	14.8	15.1
76	14.6	14.9	15.2
80	14.8	15.0	15.2
84	14.9	15.1	15.3
88	15.0	15.1	15.3
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	25	26	27
°	′	′	′
0	16.9	16.6	16.1
4	16.9	16.6	16.1
8	16.9	16.5	16.1
12	16.9	16.5	16.1
16	16.8	16.5	16.1
20	16.8	16.5	16.1
24	16.7	16.4	16.1
28	16.7	16.4	16.0
32	16.6	16.3	16.0
36	16.5	16.3	16.0
40	16.4	16.2	15.9
44	16.4	16.1	15.9
48	16.3	16.1	15.8
52	16.2	16.0	15.8
56	16.0	15.9	15.8
60	15.9	15.8	15.7
64	15.8	15.7	15.7
68	15.7	15.6	15.6
72	15.6	15.6	15.6
76	15.4	15.5	15.5
80	15.3	15.4	15.4
84	15.2	15.3	15.4
88	15.1	15.2	15.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
28 0	245 14.3	222 37.8	+ 7 49.9	167 53.0	+23 37.5	182 47.4	+20 22.8	44 42.0	− 5 45.0	10 54.0	86	−24 13.1	− 63
1	260 16.8	237 38.6	50.3	182 53.7	37.7	197 49.3	22.9	59 44.6	45.0	25 21.6	86	24 19.4	− 63
2	275 19.2	252 39.4	50.6	197 54.3	37.9	212 51.1	23.0	74 47.1	45.0	39 49.2	84	24 25.7	− 61
3	290 21.7	267 40.2	·· 51.0	212 54.9	·· 38.0	227 53.0	·· 23.2	89 49.7	·· 44.9	54 16.6	84	·24 31.8	− 60
4	305 24.2	282 41.0	51.4	227 55.5	38.2	242 54.8	23.3	104 52.3	44.9	68 44.0	83	24 37.8	− 59
5	320 26.6	297 41.8	51.7	242 56.1	38.4	257 56.7	23.4	119 54.8	44.9	83 11.3	82	24 43.7	− 57
6	335 29.1	312 42.6	+ 7 52.1	257 56.8	+23 38.5	272 58.5	+20 23.5	134 57.4	− 5 44.8	97 38.5	81	−24 49.4	− 56
7	350 31.6	327 43.4	52.5	272 57.4	38.7	288 00.4	23.6	150 00.0	44.8	112 05.6	80	24 55.0	− 55
8	5 34.0	342 44.2	52.8	287 58.0	38.9	303 02.2	23.7	165 02.5	44.8	126 32.6	79	25 00.5	− 53
9	20 36.5	357 45.0	·· 53.2	302 58.6	·· 39.0	318 04.1	·· 23.8	180 05.1	·· 44.7	140 59.5	79	·25 05.8	− 52
10	35 38.9	12 45.8	53.6	317 59.2	39.2	333 05.9	23.9	195 07.7	44.7	155 26.4	78	25 11.0	− 51
11	50 41.4	27 46.6	54.0	332 59.8	39.3	348 07.8	24.0	210 10.2	44.7	169 53.2	77	25 16.1	− 49
12	65 43.9	42 47.4	+ 7 54.3	348 00.5	+23 39.5	3 09.6	+20 24.2	225 12.8	− 5 44.7	184 19.9	76	−25 21.0	− 48
13	80 46.3	57 48.2	54.7	3 01.1	39.7	18 11.5	24.3	240 15.4	44.6	198 46.5	76	25 25.8	− 46
14	95 48.8	72 49.0	55.1	18 01.7	39.8	33 13.3	24.4	255 17.9	44.6	213 13.1	74	25 30.4	− 45
15	110 51.3	87 49.7	·· 55.5	33 02.3	·· 40.0	48 15.2	·· 24.5	270 20.5	·· 44.6	227 39.5	74	·25 34.9	− 44
16	125 53.7	102 50.5	55.9	48 02.9	40.2	63 17.0	24.6	285 23.0	44.5	242 05.9	73	25 39.3	− 42
17	140 56.2	117 51.3	56.2	63 03.6	40.3	78 18.9	24.7	300 25.6	44.5	256 32.2	73	25 43.5	− 40
18	155 58.7	132 52.1	+ 7 56.6	78 04.2	+23 40.5	93 20.7	+20 24.8	315 28.2	− 5 44.5	270 58.5	72	−25 47.5	− 39
19	171 01.1	147 52.9	57.0	93 04.8	40.6	108 22.6	24.9	330 30.7	44.4	285 24.7	71	25 51.4	− 38
20	186 03.6	162 53.6	57.4	108 05.4	40.8	123 24.4	25.0	345 33.3	44.4	299 50.8	70	25 55.2	− 36
21	201 06.1	177 54.4	·· 57.8	123 06.0	·· 41.0	138 26.3	·· 25.2	0 35.9	·· 44.4	314 16.8	70	·25 58.8	− 35
22	216 08.5	192 55.2	58.1	138 06.7	41.1	153 28.1	25.3	15 38.4	44.4	328 42.8	69	26 02.3	− 33
23	231 11.0	207 55.9	58.5	153 07.3	41.3	168 30.0	25.4	30 41.0	44.3	343 08.7	68	26 05.6	− 32
29 0	246 13.4	222 56.7	+ 7 58.9	168 07.9	+23 41.4	183 31.8	+20 25.5	45 43.6	− 5 44.3	357 34.5	68	−26 08.8	− 30
1	261 15.9	237 57.5	59.3	183 08.5	41.6	198 33.7	25.6	60 46.1	44.3	12 00.3	67	26 11.8	− 28
2	276 18.4	252 58.2	7 59.7	198 09.1	41.8	213 35.5	25.7	75 48.7	44.2	26 26.0	67	26 14.6	− 27
3	291 20.8	267 59.0	· 8 00.1	213 09.7	·· 41.9	228 37.4	·· 25.8	90 51.2	·· 44.2	40 51.7	66	·26 17.3	− 26
4	306 23.3	282 59.8	00.5	228 10.4	42.1	243 39.2	25.9	105 53.8	44.2	55 17.3	65	26 19.9	− 24
5	321 25.8	298 00.5	00.9	243 11.0	42.2	258 41.1	26.0	120 56.4	44.1	69 42.8	65	26 22.3	− 22
6	336 28.2	313 01.3	+ 8 01.3	258 11.6	+23 42.4	273 42.9	+20 26.1	135 58.9	− 5 44.1	84 08.3	65	−26 24.5	− 21
7	351 30.7	328 02.0	01.7	273 12.2	42.5	288 44.8	26.3	151 01.5	44.1	98 33.8	64	26 26.6	− 19
8	6 33.2	343 02.8	02.0	288 12.8	42.7	303 46.6	26.4	166 04.0	44.1	112 59.2	63	26 28.5	− 18
9	21 35.6	358 03.6	·· 02.4	303 13.5	·· 42.8	318 48.5	·· 26.5	181 06.6	·· 44.0	127 24.5	63	·26 30.3	− 16
10	36 38.1	13 04.3	02.8	318 14.1	43.0	333 50.3	26.6	196 09.2	44.0	141 49.8	63	26 31.9	− 14
11	51 40.6	28 05.1	03.2	333 14.7	43.2	348 52.2	26.7	211 11.7	44.0	156 15.1	62	26 33.3	− 13
12	66 43.0	43 05.8	+ 8 03.6	348 15.3	+23 43.3	3 54.0	+20 26.8	226 14.3	− 5 43.9	170 40.3	61	−26 34.6	− 11
13	81 45.5	58 06.6	04.0	3 15.9	43.5	18 55.9	26.9	241 16.9	43.9	185 05.4	62	26 35.7	− 10
14	96 47.9	73 07.3	04.4	18 16.5	43.6	33 57.7	27.0	256 19.4	43.9	199 30.6	60	26 36.7	− 8
15	111 50.4	88 08.1	·· 04.8	33 17.2	·· 43.8	48 59.6	·· 27.1	271 22.0	·· 43.9	213 55.6	61	·26 37.5	− 6
16	126 52.9	103 08.8	05.2	48 17.8	43.9	64 01.4	27.2	286 24.5	43.8	228 20.7	60	26 38.1	− 5
17	141 55.3	118 09.5	05.6	63 18.4	44.1	79 03.3	27.4	301 27.1	43.8	242 45.7	60	26 38.6	− 3
18	156 57.8	133 10.3	+ 8 06.0	78 19.0	+23 44.2	94 05.1	+20 27.5	316 29.7	− 5 43.8	257 10.7	59	−26 38.9	− 1
19	172 00.3	148 11.0	06.4	93 19.6	44.4	109 07.0	27.6	331 32.2	43.7	271 35.6	60	26 39.0	0
20	187 02.7	163 11.8	06.9	108 20.3	44.5	124 08.8	27.7	346 34.8	43.7	286 00.6	59	26 39.0	+ 2
21	202 05.2	178 12.5	·· 07.3	123 20.9	·· 44.7	139 10.7	·· 27.8	1 37.3	·· 43.7	300 25.5	58	·26 38.8	+ 3
22	217 07.7	193 13.2	07.7	138 21.5	44.8	154 12.5	27.9	16 39.9	43.7	314 50.3	59	26 38.5	+ 5
23	232 10.1	208 14.0	08.1	153 22.1	45.0	169 14.4	28.0	31 42.5	43.6	329 15.2	58	26 38.0	+ 7
30 0	247 12.6	223 14.7	+ 8 08.5	168 22.7	+23 45.1	184 16.2	+20 28.1	46 45.0	− 5 43.6	343 40.0	58	−26 37.3	+ 9
1	262 15.1	238 15.4	08.9	183 23.4	45.3	199 18.1	28.2	61 47.6	43.6	358 04.8	58	26 36.4	+ 10
2	277 17.5	253 16.1	09.3	198 24.0	45.4	214 19.9	28.3	76 50.1	43.5	12 29.6	58	26 35.4	+ 12
3	292 20.0	268 16.9	·· 09.7	213 24.6	·· 45.6	229 21.8	·· 28.4	91 52.7	·· 43.5	26 54.4	58	·26 34.2	+ 13
4	307 22.4	283 17.6	10.1	228 25.2	45.7	244 23.6	28.6	106 55.2	43.5	41 19.2	58	26 32.9	+ 15
5	322 24.9	298 18.3	10.5	243 25.8	45.9	259 25.5	28.7	121 57.8	43.5	55 44.0	57	26 31.4	+ 17
6	337 27.4	313 19.0	+ 8 11.0	258 26.4	+23 46.0	274 27.3	+20 28.8	137 00.4	− 5 43.4	70 08.7	58	−26 29.7	+ 19
7	352 29.8	328 19.8	11.4	273 27.1	46.2	289 29.2	28.9	152 02.9	43.4	84 33.5	57	26 27.8	+ 20
8	7 32.3	343 20.5	11.8	288 27.7	46.3	304 31.0	29.0	167 05.5	43.4	98 58.2	57	26 25.8	+ 22
9	22 34.8	358 21.2	·· 12.2	303 28.3	·· 46.5	319 32.9	·· 29.1	182 08.0	·· 43.3	113 22.9	58	·26 23.6	+ 23
10	37 37.2	13 21.9	12.6	318 28.9	46.6	334 34.7	29.2	197 10.6	43.3	127 47.7	57	26 21.3	+ 25
11	52 39.7	28 22.6	13.0	333 29.5	46.7	349 36.6	29.3	212 13.2	43.3	142 12.4	58	26 18.8	+ 27
12	67 42.2	43 23.3	+ 8 13.5	348 30.2	+23 46.9	4 38.4	+20 29.4	227 15.7	− 5 43.3	156 37.2	57	−26 16.1	+ 29
13	82 44.6	58 24.1	13.9	3 30.8	47.0	19 40.3	29.5	242 18.3	43.2	171 01.9	58	26 13.2	+ 30
14	97 47.1	73 24.8	14.3	18 31.4	47.2	34 42.1	29.6	257 20.8	43.2	185 26.7	57	26 10.2	+ 31
15	112 49.6	88 25.5	·· 14.7	33 32.0	·· 47.3	49 44.0	·· 29.7	272 23.4	·· 43.2	199 51.4	58	·26 07.1	+ 34
16	127 52.0	103 26.2	15.1	48 32.6	47.5	64 45.8	29.9	287 25.9	43.1	214 16.2	58	26 03.7	+ 35
17	142 54.5	118 26.9	15.6	63 33.3	47.6	79 47.7	30.0	302 28.5	43.1	228 41.0	58	26 00.2	+ 37
18	157 56.9	133 27.6	+ 8 16.0	78 33.9	+23 47.8	94 49.5	+20 30.1	317 31.1	− 5 43.1	243 05.8	58	−25 56.5	+ 38
19	172 59.4	148 28.3	16.4	93 34.5	47.9	109 51.4	30.2	332 33.6	43.1	257 30.6	59	25 52.7	+ 40
20	188 01.9	163 29.0	16.8	108 35.1	48.0	124 53.2	30.3	347 36.2	43.0	271 55.5	58	25 48.7	+ 42
21	203 04.3	178 29.7	·· 17.3	123 35.7	·· 48.2	139 55.1	·· 30.4	2 38.7	·· 43.0	286 20.3	59	·25 44.5	+ 43
22	218 06.8	193 30.4	17.7	138 36.3	48.3	154 56.9	30.5	17 41.3	43.0	300 45.2	59	25 40.2	+ 45
23	233 09.3	208 31.1	18.1	153 37.0	48.5	169 58.8	30.6	32 43.8	43.0	315 10.1	60	25 35.7	+ 47
24	248 11.7	223 31.8	+ 8 18.6	168 37.6	+23 48.6	185 00.6	+20 30.7	47 46.4	− 5 42.9	329 35.1	59	−25 31.0	+ 48
code		+ 8	+ 4	+ 6	+ 2	+ 19	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
28 h 0	180 44.2	+21 22.7
1	195 44.1	23.1
2	210 44.1	23.5
3	225 44.0	23.9
4	240 43.9	24.3
5	255 43.8	24.7
6	270 43.8	+21 25.1
7	285 43.7	25.6
8	300 43.6	26.0
9	315 43.5	26.4
10	330 43.5	26.8
11	345 43.4	27.2
12	0 43.3	+21 27.6
13	15 43.2	28.0
14	30 43.2	28.4
15	45 43.1	28.8
16	60 43.0	29.2
17	75 42.9	29.6
18	90 42.9	+21 30.0
19	105 42.8	30.4
20	120 42.7	30.8
21	135 42.6	31.2
22	150 42.6	31.6
23	165 42.5	32.0
29 0	180 42.4	+21 32.4
1	195 42.3	32.8
2	210 42.2	33.2
3	225 42.2	33.5
4	240 42.1	33.9
5	255 42.0	34.3
6	270 41.9	+21 34.7
7	285 41.9	35.1
8	300 41.8	35.5
9	315 41.7	35.9
10	330 41.6	36.3
11	345 41.5	36.7
12	0 41.5	+21 37.1
13	15 41.4	37.4
14	30 41.3	37.8
15	45 41.2	38.2
16	60 41.1	38.6
17	75 41.1	39.0
18	90 41.0	+21 39.4
19	105 40.9	39.8
20	120 40.8	40.1
21	135 40.7	40.5
22	150 40.6	40.9
23	165 40.6	41.3
30 0	180 40.5	+21 41.7
1	195 40.4	42.0
2	210 40.3	42.4
3	225 40.2	42.8
4	240 40.2	43.2
5	255 40.1	43.6
6	270 40.0	+21 43.9
7	285 39.9	44.3
8	300 39.8	44.7
9	315 39.7	45.1
10	330 39.6	45.4
11	345 39.6	45.8
12	0 39.5	+21 46.2
13	15 39.4	46.5
14	30 39.3	46.9
15	45 39.2	47.3
16	60 39.1	47.7
17	75 39.1	48.0
18	90 39.0	+21 48.4
19	105 38.9	48.8
20	120 38.8	49.1
21	135 38.7	49.5
22	150 38.6	49.9
23	165 38.5	50.2
24	180 38.4	+21 50.6
code	−	+ 3

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.8	−40 29.3
5	Achernar	336 00.5	−57 28.1
30	Acrux	173 59.7	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.6	+56 12.9
34	Alkaid	153 33.8	+49 32.7
55	Al Na'ir	28 40.0	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.5	− 8 27.5
41	Alphecca	126 48.8	+26 52.1
1	Alpheratz	358 30.4	+28 49.9
51	Altair	62 51.9	+ 8 44.5
2	Ankaa	354 00.2	−42 33.3
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.8
22	Avior	234 37.0	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.1	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.2	−18 14.4
27	Dubhe	194 46.5	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.4
54	Enif	34 31.3	+ 9 39.6
56	Fomalhaut	16 13.6	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 52.0	+23 14.6
48	Kaus Aust.	84 43.2	−34 24.6
40	Kochab	137 16.4	+74 20.8
57	Markab	14 23.3	+14 57.2
8	Menkar	315 02.5	+ 3 54.5
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.0	−69 31.8
9	Mirfak	309 45.5	+49 41.8
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.7	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.5	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.9
49	Vega	81 09.1	+38 44.1
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 28	29	30
h	m s	m s	m s
0	+ 2 57.0	+ 2 49.8	+ 2 42.1
6	+ 2 55.2	+ 2 47.9	+ 2 40.1
12	+ 2 53.4	+ 2 46.0	+ 2 38.1
18	+ 2 51.6	+ 2 44.1	+ 2 36.0
24	+ 2 49.8	+ 2 42.1	+ 2 34.0

Lat.	Sunrise	Twlt. begins	Moonrise 28	29	30	31
N	h m	h m	h m	h m	h m	h m
72	▭	▭	▬	▬	▬	▬
70	▭	▭	▬	▬	▬	▬
68	▭	▭	▬	▬	▬	▬
66	1 26	////	▬	▬	▬	▬
64	2 06	////	▬	▬	▬	1 19
62	2 33	////	22 38	23 51	24 21	0 21
60	2 54	////	21 58	23 07	23 47	24 07
58	3 11	////	21 31	22 37	23 22	23 48
56	3 26	////	21 10	22 15	23 02	23 33
54	3 38	////	20 52	21 57	22 45	23 20
52	3 49	////	20 37	21 41	22 31	23 08
50	3 58	0 33	20 24	21 27	22 19	22 57
45	4 18	1 58	19 58	21 00	21 53	22 36
40	4 35	2 38	19 37	20 38	21 32	22 18
35	4 48	3 06	19 19	20 20	21 15	22 03
30	5 00	3 27	19 04	20 04	21 00	21 50
20	5 20	3 58	18 39	19 38	20 35	21 28
10	5 38	4 22	18 17	19 15	20 13	21 09
0	5 54	4 40	17 57	18 54	19 53	20 50
10	6 09	4 55	17 36	18 33	19 32	20 32
20	6 26	5 08	17 15	18 10	19 10	20 13
30	6 46	5 21	16 50	17 44	18 45	19 50
35	6 57	5 27	16 35	17 29	18 30	19 37
40	7 10	5 33	16 19	17 11	18 13	19 22
45	7 25	5 39	15 58	16 49	17 52	19 04
50	7 44	5 46	15 32	16 22	17 25	18 41
52	7 52	5 48	15 20	16 08	17 13	18 30
54	8 02	5 52	15 06	15 53	16 58	18 17
56	8 13	5 55	14 50	15 35	16 41	18 03
58	8 26	5 58	14 30	15 13	16 20	17 46
60	8 41	6 01	14 06	14 45	15 53	17 25
S						

Lat.	Sunset	Twlt. ends	Moonset 28	29	30	31
N	h m	h m	h m	h m	h m	h m
72	▭	▭	▬	▬	▬	▬
70	▭	▭	▬	▬	▬	▬
68	▭	▭	▬	▬	▬	▬
66	22 33	////	▬	▬	▬	▬
64	21 51	////	0 44	▬	▬	3 01
62	21 23	////	1 24	1 39	2 26	4 00
60	21 02	////	1 51	2 18	3 10	4 33
58	20 44	////	2 13	2 45	3 40	4 57
56	20 30	////	2 31	3 07	4 02	5 17
54	20 17	////	2 46	3 25	4 20	5 33
52	20 07	////	2 59	3 40	4 36	5 47
50	19 57	23 28	3 10	3 53	4 50	6 00
45	19 37	21 59	3 34	4 20	5 17	6 25
40	19 20	21 18	3 54	4 41	5 39	6 45
35	19 07	20 51	4 10	4 59	5 57	7 01
30	18 55	20 29	4 24	5 14	6 12	7 16
20	18 34	19 57	4 48	5 40	6 39	7 40
10	18 17	19 34	5 08	6 03	7 01	8 01
0	18 01	19 15	5 28	6 24	7 22	8 21
10	17 45	19 00	5 47	6 45	7 43	8 40
20	17 28	18 46	6 08	7 07	8 05	9 01
30	17 09	18 33	6 32	7 33	8 31	9 24
35	16 57	18 26	6 46	7 48	8 47	9 38
40	16 44	18 20	7 03	8 06	9 04	9 54
45	16 29	18 14	7 23	8 28	9 25	10 13
50	16 11	18 08	7 47	8 55	9 52	10 37
52	16 02	18 05	7 59	9 08	10 05	10 48
54	15 52	18 02	8 13	9 23	10 20	11 01
56	15 41	17 59	8 29	9 41	10 37	11 16
58	15 28	17 55	8 48	10 03	10 58	11 33
60	15 13	17 52	9 12	10 31	11 25	11 54
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
28	24 10	9 09	12 48	11 47	20 58
29	0 10	9 08	12 47	11 44	20 54
30	1 08	9 07	12 46	11 42	20 50
31	2 07	9 06	12 45	11 39	20 45

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.3	0.1
30	0.1	0.2	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	28	29	30
°	′	′	′
0	15.3	15.9	16.6
4	15.3	15.9	16.6
8	15.3	15.9	16.6
12	15.3	15.9	16.5
16	15.3	15.9	16.5
20	15.3	15.9	16.5
24	15.3	15.9	16.5
28	15.3	15.9	16.5
32	15.3	15.9	16.4
36	15.3	15.9	16.4
40	15.3	15.9	16.4
44	15.4	15.8	16.3
48	15.4	15.8	16.3
52	15.4	15.8	16.2
56	15.4	15.8	16.2
60	15.4	15.8	16.1
64	15.4	15.8	16.1
68	15.4	15.7	16.0
72	15.4	15.7	16.0
76	15.5	15.7	15.9
80	15.5	15.7	15.9
84	15.5	15.7	15.8
88	15.5	15.6	15.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	28	29	30
°	′	′	′
0	15.7	15.3	15.0
4	15.7	15.3	15.0
8	15.7	15.3	15.0
12	15.7	15.3	15.0
16	15.7	15.3	15.0
20	15.7	15.4	15.0
24	15.7	15.4	15.0
28	15.7	15.4	15.1
32	15.7	15.4	15.1
36	15.7	15.4	15.1
40	15.6	15.4	15.2
44	15.6	15.4	15.2
48	15.6	15.4	15.3
52	15.6	15.5	15.3
56	15.6	15.5	15.3
60	15.6	15.5	15.4
64	15.6	15.5	15.4
68	15.6	15.5	15.5
72	15.6	15.5	15.5
76	15.5	15.6	15.6
80	15.5	15.6	15.7
84	15.5	15.6	15.7
88	15.5	15.6	15.8
90			

Subtract from table, back cover

Full Moon 28
Memorial Day 30

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.7 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
31 0	248 11.7	223 31.8	+ 8 18.6	168 37.6	+23 48.6	185 00.6	+20 30.7	47 46.4	− 5 42.9	329 35.1	59	−25 31.0	+ 48
1	263 14.2	238 32.5	19.0	183 38.2	48.7	200 02.5	30.8	62 48.9	42.9	344 00.0	60	25 26.2	+ 50
2	278 16.7	253 33.2	19.4	198 38.8	48.9	215 04.3	30.9	77 51.5	42.9	358 25.0	60	25 21.2	+ 51
3	293 19.1	268 33.9	•• 19.9	213 39.4	•• 49.0	230 06.2	•• 31.1	92 54.1	•• 42.9	12 50.0	61	•25 16.1	+ 53
4	308 21.6	283 34.5	20.3	228 40.1	49.2	245 08.0	31.2	107 56.6	42.8	27 15.1	61	25 10.8	+ 55
5	323 24.0	298 35.2	20.7	243 40.7	49.3	260 09.9	31.3	122 59.2	42.8	41 40.2	61	25 05.3	+ 56
6	338 26.5	313 35.9	+ 8 21.2	258 41.3	+23 49.4	275 11.7	+20 31.4	138 01.7	− 5 42.8	56 05.3	62	−24 59.7	+ 58
7	353 29.0	328 36.6	21.6	273 41.9	49.6	290 13.6	31.5	153 04.3	42.7	70 30.5	61	24 53.9	+ 60
8	8 31.4	343 37.3	22.0	288 42.5	49.7	305 15.4	31.6	168 06.8	42.7	84 55.6	63	24 47.9	+ 61
9	23 33.9	358 38.0	•• 22.5	303 43.1	•• 49.9	320 17.3	•• 31.7	183 09.4	•• 42.7	99 20.9	63	•24 41.8	+ 62
10	38 36.4	13 38.6	22.9	318 43.8	50.0	335 19.1	31.8	198 11.9	42.7	113 46.2	63	24 35.6	+ 64
11	53 38.8	28 39.3	23.3	333 44.4	50.1	350 21.0	31.9	213 14.5	42.6	128 11.5	64	24 29.2	+ 66
12	68 41.3	43 40.0	+ 8 23.8	348 45.0	+23 50.3	5 22.8	+20 32.0	228 17.1	− 5 42.6	142 36.9	64	−24 22.6	+ 67
13	83 43.8	58 40.7	24.2	3 45.6	50.4	20 24.7	32.1	243 19.6	42.6	157 02.3	64	24 15.9	+ 69
14	98 46.2	73 41.4	24.7	18 46.2	50.5	35 26.5	32.2	258 22.2	42.6	171 27.7	65	24 09.0	+ 70
15	113 48.7	88 42.0	•• 25.1	33 46.9	•• 50.7	50 28.4	•• 32.3	273 24.7	•• 42.5	185 53.2	66	•24 02.0	+ 72
16	128 51.2	103 42.7	25.6	48 47.5	50.8	65 30.2	32.5	288 27.3	42.5	200 18.8	66	23 54.8	+ 73
17	143 53.6	118 43.4	26.0	63 48.1	50.9	80 32.1	32.6	303 29.8	42.5	214 44.4	67	23 47.5	+ 75
18	158 56.1	133 44.0	+ 8 26.4	78 48.7	+23 51.1	95 33.9	+20 32.7	318 32.4	− 5 42.5	229 10.1	67	−23 40.0	+ 76
19	173 58.5	148 44.7	26.9	93 49.3	51.2	110 35.8	32.8	333 34.9	42.4	243 35.8	68	23 32.4	+ 78
20	189 01.0	163 45.4	27.3	108 50.0	51.3	125 37.6	32.9	348 37.5	42.4	258 01.6	68	23 24.6	+ 79
21	204 03.5	178 46.0	•• 27.8	123 50.6	•• 51.5	140 39.5	•• 33.0	3 40.0	•• 42.4	272 27.4	69	•23 16.7	+ 81
22	219 05.9	193 46.7	28.2	138 51.2	51.6	155 41.3	33.1	18 42.6	42.4	286 53.3	69	23 08.6	+ 82
23	234 08.4	208 47.4	28.7	153 51.8	51.7	170 43.2	33.2	33 45.1	42.3	301 19.2	70	23 00.4	+ 83
1 0	249 10.9	223 48.0	+ 8 29.1	168 52.4	+23 51.9	185 45.0	+20 33.3	48 47.7	− 5 42.3	315 45.2	70	−22 52.1	+ 85
1	264 13.3	238 48.7	29.6	183 53.1	52.0	200 46.9	33.4	63 50.2	42.3	330 11.2	71	22 43.6	+ 87
2	279 15.8	253 49.3	30.0	198 53.7	52.1	215 48.7	33.5	78 52.8	42.3	344 37.3	72	22 34.9	+ 87
3	294 18.3	268 50.0	•• 30.5	213 54.3	•• 52.3	230 50.6	•• 33.6	93 55.3	•• 42.2	359 03.5	73	•22 26.2	+ 90
4	309 20.7	283 50.6	30.9	228 54.9	52.4	245 52.4	33.7	108 57.9	42.2	13 29.8	72	22 17.2	+ 90
5	324 23.2	298 51.3	31.4	243 55.5	52.5	260 54.3	33.8	124 00.5	42.2	27 56.0	74	22 08.2	+ 92
6	339 25.7	313 52.0	+ 8 31.8	258 56.1	+23 52.7	275 56.1	+20 34.0	139 03.0	− 5 42.2	42 22.4	74	−21 59.0	+ 93
7	354 28.1	328 52.6	32.3	273 56.8	52.8	290 58.0	34.1	154 05.6	42.1	56 48.8	75	21 49.7	+ 95
8	9 30.6	343 53.2	32.8	288 57.4	52.9	305 59.8	34.2	169 08.1	42.1	71 15.3	76	21 40.2	+ 96
9	24 33.0	358 53.9	•• 33.2	303 58.0	•• 53.0	321 01.7	•• 34.3	184 10.7	•• 42.1	85 41.9	76	•21 30.6	+ 97
10	39 35.5	13 54.5	33.7	318 58.6	53.2	336 03.5	34.4	199 13.2	42.1	100 08.5	76	21 20.9	+ 99
11	54 38.0	28 55.2	34.1	333 59.2	53.3	351 05.4	34.5	214 15.8	42.0	114 35.1	78	21 11.0	+100
12	69 40.4	43 55.8	+ 8 34.6	348 59.9	+23 53.4	6 07.2	+20 34.6	229 18.3	− 5 42.0	129 01.9	78	−21 01.0	+101
13	84 42.9	58 56.5	35.1	4 00.5	53.5	21 09.1	34.7	244 20.9	42.0	143 28.7	79	20 50.9	+102
14	99 45.4	73 57.1	35.5	19 01.1	53.7	36 10.9	34.8	259 23.4	42.0	157 55.6	79	20 40.7	+104
15	114 47.8	88 57.8	•• 36.0	34 01.7	•• 53.8	51 12.8	•• 34.9	274 26.0	•• 41.9	172 22.5	80	•20 30.3	+105
16	129 50.3	103 58.4	36.4	49 02.3	53.9	66 14.6	35.0	289 28.5	41.9	186 49.5	81	20 19.8	+106
17	144 52.8	118 59.0	36.9	64 03.0	54.1	81 16.5	35.1	304 31.1	41.9	201 16.6	82	20 09.2	+107
18	159 55.2	133 59.7	+ 8 37.4	79 03.6	+23 54.2	96 18.3	+20 35.2	319 33.6	− 5 41.9	215 43.8	82	−19 58.5	+109
19	174 57.7	149 00.3	37.8	94 04.2	54.3	111 20.2	35.3	334 36.2	41.8	230 11.0	82	19 47.6	+110
20	190 00.2	164 00.9	38.3	109 04.8	54.4	126 22.0	35.4	349 38.7	41.8	244 38.2	84	19 36.6	+110
21	205 02.6	179 01.6	•• 38.8	124 05.4	•• 54.6	141 23.9	•• 35.6	4 41.3	•• 41.8	259 05.6	84	•19 25.6	+113
22	220 05.1	194 02.2	39.2	139 06.1	54.7	156 25.7	35.7	19 43.8	41.8	273 33.0	85	19 14.3	+113
23	235 07.5	209 02.8	39.7	154 06.7	54.8	171 27.6	35.8	34 46.4	41.7	288 00.5	85	19 03.0	+114
2 0	250 10.0	224 03.4	+ 8 40.2	169 07.3	+23 54.9	186 29.4	+20 35.9	49 48.9	− 5 41.7	302 28.0	87	−18 51.6	+116
1	265 12.5	239 04.1	40.6	184 07.9	55.0	201 31.3	36.0	64 51.5	41.7	316 55.7	87	18 40.0	+116
2	280 14.9	254 04.7	41.1	199 08.5	55.2	216 33.1	36.1	79 54.0	41.7	331 23.4	87	18 28.4	+118
3	295 17.4	269 05.3	•• 41.6	214 09.1	•• 55.3	231 35.0	•• 36.2	94 56.6	•• 41.6	345 51.1	88	•18 16.6	+119
4	310 19.9	284 05.9	42.1	229 09.8	55.4	246 36.8	36.3	109 59.1	41.6	0 18.9	89	18 04.7	+120
5	325 22.3	299 06.6	42.5	244 10.4	55.5	261 38.7	36.4	125 01.7	41.6	14 46.8	90	17 52.7	+121
6	340 24.8	314 07.2	+ 8 43.0	259 11.0	+23 55.7	276 40.5	+20 36.5	140 04.2	− 5 41.6	29 14.8	90	−17 40.6	+122
7	355 27.3	329 07.8	43.5	274 11.6	55.8	291 42.4	36.6	155 06.7	41.5	43 42.8	91	17 28.4	+123
8	10 29.7	344 08.4	43.9	289 12.2	55.9	306 44.2	36.7	170 09.3	41.5	58 10.9	91	17 16.1	+124
9	25 32.2	359 09.0	•• 44.4	304 12.9	•• 56.0	321 46.1	•• 36.8	185 11.8	•• 41.5	72 39.0	93	•17 03.7	+125
10	40 34.6	14 09.6	44.9	319 13.5	56.1	336 47.9	36.9	200 14.4	41.5	87 07.3	93	16 51.2	+126
11	55 37.1	29 10.2	45.4	334 14.1	56.3	351 49.8	37.0	215 16.9	41.5	101 35.6	93	16 38.6	+127
12	70 39.6	44 10.9	+ 8 45.9	349 14.7	+23 56.4	6 51.6	+20 37.1	230 19.5	− 5 41.4	116 03.9	94	−16 25.9	+128
13	85 42.0	59 11.5	46.3	4 15.3	56.5	21 53.5	37.2	245 22.0	41.4	130 32.3	95	16 13.1	+128
14	100 44.5	74 12.1	46.8	19 16.0	56.6	36 55.3	37.4	260 24.6	41.4	145 00.8	96	16 00.3	+130
15	115 47.0	89 12.7	•• 47.3	34 16.6	•• 56.7	51 57.2	•• 37.5	275 27.1	•• 41.4	159 29.4	96	•15 47.3	+131
16	130 49.4	104 13.3	47.8	49 17.2	56.8	66 59.0	37.6	290 29.7	41.3	173 58.0	96	15 34.2	+132
17	145 51.9	119 13.9	48.3	64 17.8	57.0	82 00.9	37.7	305 32.2	41.3	188 26.6	98	15 21.0	+132
18	160 54.4	134 14.5	+ 8 48.7	79 18.4	+23 57.1	97 02.7	+20 37.8	320 34.8	− 5 41.3	202 55.4	98	−15 07.8	+133
19	175 56.8	149 15.1	49.2	94 19.1	57.2	112 04.6	37.9	335 37.3	41.3	217 24.2	98	14 54.5	+135
20	190 59.3	164 15.7	49.7	109 19.7	57.3	127 06.4	38.0	350 39.9	41.2	231 53.0	99	14 41.0	+135
21	206 01.8	179 16.3	•• 50.2	124 20.3	•• 57.4	142 08.3	•• 38.1	5 42.4	•• 41.2	246 21.9	100	•14 27.5	+135
22	221 04.2	194 16.9	50.7	139 20.9	57.5	157 10.1	38.2	20 45.0	41.2	260 50.9	100	14 14.0	+137
23	236 06.7	209 17.5	51.2	154 21.5	57.7	172 12.0	38.3	35 47.5	41.2	275 19.9	101	14 00.3	+138
24	251 09.1	224 18.1	+ 8 51.7	169 22.2	+23 57.8	187 13.8	+20 38.4	50 50.0	− 5 41.2	289 49.0	102	−13 46.5	+138
code	−	+ 7	+ 5	+ 6	+ 1	+ 19	+ 1	+ 26	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
31 0	180 38.4	+21 50.6
1	195 38.4	51.0
2	210 38.3	51.3
3	225 38.2 ••	51.7
4	240 38.1	52.0
5	255 38.0	52.4
6	270 37.9	+21 52.8
7	285 37.8	53.1
8	300 37.7	53.5
9	315 37.7 ••	53.8
10	330 37.6	54.2
11	345 37.5	54.6
12	0 37.4	+21 54.9
13	15 37.3	55.3
14	30 37.2	55.6
15	45 37.1 ••	56.0
16	60 37.0	56.3
17	75 36.9	56.7
18	90 36.9	+21 57.0
19	105 36.8	57.4
20	120 36.7	57.7
21	135 36.6 ••	58.1
22	150 36.5	58.4
23	165 36.4	58.8
1 0	180 36.3	+21 59.1
1	195 36.2	59.5
2	210 36.1	21 59.8
3	225 36.0 ••	22 00.2
4	240 35.9	00.5
5	255 35.8	00.9
6	270 35.8	+22 01.2
7	285 35.7	01.6
8	300 35.6	01.9
9	315 35.5 ••	02.2
10	330 35.4	02.6
11	345 35.3	02.9
12	0 35.2	+22 03.3
13	15 35.1	03.6
14	30 35.0	03.9
15	45 34.9 ••	04.3
16	60 34.8	04.6
17	75 34.7	05.0
18	90 34.6	+22 05.3
19	105 34.5	05.6
20	120 34.4	06.0
21	135 34.4 ••	06.3
22	150 34.3	06.6
23	165 34.2	07.0
2 0	180 34.1	+22 07.3
1	195 34.0	07.6
2	210 33.9	08.0
3	225 33.8 ••	08.3
4	240 33.7	08.6
5	255 33.6	09.0
6	270 33.5	+22 09.3
7	285 33.4	09.6
8	300 33.3	09.9
9	315 33.2 ••	10.3
10	330 33.1	10.6
11	345 33.0	10.9
12	0 32.9	+22 11.2
13	15 32.8	11.6
14	30 32.7	11.9
15	45 32.6 ••	12.2
16	60 32.5	12.5
17	75 32.4	12.9
18	90 32.3	+22 13.2
19	105 32.2	13.5
20	120 32.1	13.8
21	135 32.0 ••	14.1
22	150 31.9	14.4
23	165 31.8	14.8
24	180 31.7	+22 15.1
code	−	+ 3

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.2
5	Achernar	336 00.4	−57 28.1
30	Acrux	173 59.7	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.6	+56 12.9
34	Alkaid	153 33.8	+49 32.8
55	Al Na'ir	28 40.0	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.5	− 8 27.5
41	Alphecca	126 48.7	+26 52.1
1	Alpheratz	358 30.4	+28 49.9
51	Altair	62 51.9	+ 8 44.5
2	Ankaa	354 00.1	−42 33.3
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.8
22	Avior	234 37.0	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.0	+45 06.5
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.2	−18 14.4
27	Dubhe	194 46.5	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.6	+51 29.4
54	Enif	34 31.3	+ 9 39.6
56	Fomalhaut	16 13.5	−29 52.0
31	Gacrux	172 51.1	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 52.0	+23 14.6
48	Kaus Aust.	84 43.2	−34 24.6
40	Kochab	137 16.4	+74 20.8
57	Markab	14 23.3	+14 57.2
8	Menkar	315 02.5	+ 3 54.6
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.0	−69 31.8
9	Mirfak	309 45.5	+49 41.8
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.6	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.4	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.1
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.9
49	Vega	81 09.1	+38 44.2
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 31	1	2
h	m s	m s	m s
0	+ 2 34.0	+ 2 25.4	+ 2 16.4
6	+ 2 31.9	+ 2 23.2	+ 2 14.1
12	+ 2 29.7	+ 2 21.0	+ 2 11.8
18	+ 2 27.6	+ 2 18.7	+ 2 09.4
24	+ 2 25.4	+ 2 16.4	+ 2 07.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 31 h m	1 h m	2 h m	3 h m
72	▭	▭	▬	▬	▬	1 55
70	▭	▭	▬	▬	2 24	1 30
68	▭	▭	▬	▬	1 41	1 11
66	1 13	////	▬	1 43	1 12	0 56
64	1 58	////	1 19	0 59	0 50	0 43
62	2 27	////	0 21	0 29	0 32	0 32
60	2 50	////	24 07	0 07	0 17	0 23
58	3 07	////	23 48	24 04	0 04	0 15
56	3 22	////	23 33	23 53	24 07	0 07
54	3 35	////	23 20	23 43	24 01	0 01
52	3 46	////	23 08	23 35	23 55	24 12
50	3 56	0 03	22 57	23 27	23 50	24 09
45	4 17	1 54	22 36	23 10	23 38	24 02
40	4 33	2 35	22 18	22 56	23 28	23 57
35	4 47	3 04	22 03	22 44	23 20	23 52
30	4 59	3 26	21 50	22 34	23 13	23 48
20	5 20	3 57	21 28	22 16	23 00	23 41
10	5 38	4 21	21 09	22 01	22 49	23 35
0	5 54	4 40	20 50	21 46	22 39	23 29
10	6 10	4 55	20 32	21 31	22 28	23 23
20	6 28	5 09	20 13	21 15	22 17	23 17
30	6 47	5 22	19 50	20 57	22 04	23 09
35	6 59	5 28	19 37	20 47	21 56	23 05
40	7 12	5 35	19 22	20 34	21 48	23 00
45	7 28	5 42	19 04	20 20	21 38	22 55
50	7 47	5 49	18 41	20 02	21 25	22 48
52	7 56	5 52	18 30	19 54	21 20	22 45
54	8 06	5 55	18 17	19 44	21 13	22 42
56	8 17	5 58	18 03	19 34	21 06	22 38
58	8 31	6 01	17 46	19 21	20 58	22 34
60 S	8 46	6 04	17 25	19 07	20 49	22 29

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 31 h m	1 h m	2 h m	3 h m
72	▭	▭	▬	▬	▬	8 14
70	▭	▭	▬	▬	5 54	8 37
68	▭	▭	▬	▬	6 36	8 54
66	22 47	////	▬	4 38	7 03	9 08
64	21 59	////	3 01	5 21	7 24	9 19
62	21 30	////	4 00	5 50	7 41	9 28
60	21 07	////	4 33	6 12	7 55	9 36
58	20 49	////	4 57	6 30	8 07	9 43
56	20 34	////	5 17	6 45	8 17	9 50
54	20 21	////	5 33	6 58	8 26	9 55
52	20 10	////	5 47	7 09	8 34	10 00
50	20 00	////	6 00	7 19	8 42	10 05
45	19 39	22 03	6 25	7 39	8 57	10 14
40	19 22	21 21	6 45	7 56	9 09	10 22
35	19 08	20 52	7 01	8 10	9 20	10 29
30	18 56	20 31	7 16	8 22	9 29	10 35
20	18 36	19 59	7 40	8 43	9 45	10 45
10	18 18	19 35	8 01	9 01	9 59	10 54
0	18 01	19 15	8 21	9 17	10 11	11 03
10	17 45	19 00	8 40	9 34	10 24	11 11
20	17 28	18 46	9 01	9 51	10 37	11 20
30	17 08	18 33	9 24	10 11	10 52	11 29
35	16 56	18 26	9 38	10 23	11 01	11 35
40	16 43	18 19	9 54	10 36	11 11	11 41
45	16 27	18 12	10 13	10 52	11 23	11 49
50	16 08	18 05	10 37	11 11	11 37	11 57
52	15 59	18 02	10 48	11 20	11 43	12 01
54	15 49	18 00	11 01	11 30	11 50	12 06
56	15 38	17 57	11 16	11 41	11 58	12 11
58	15 24	17 53	11 33	11 54	12 07	12 16
60 S	15 09	17 49	11 54	12 09	12 17	12 22

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
31	2 07	9 06	12 45	11 39	20 45
1	3 04	9 04	12 44	11 36	20 41
2	3 59	9 03	12 43	11 33	20 37
3	4 51	9 02	12 42	11 30	20 33

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.3	0.1
30	0.1	0.2	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	31 ′	1 ′	2 ′
0	17.2	17.7	18.0
4	17.2	17.7	18.0
8	17.2	17.7	17.9
12	17.2	17.7	17.9
16	17.1	17.6	17.9
20	17.1	17.6	17.8
24	17.1	17.5	17.8
28	17.0	17.5	17.7
32	17.0	17.4	17.6
36	16.9	17.4	17.6
40	16.9	17.3	17.5
44	16.8	17.2	17.4
48	16.7	17.1	17.3
52	16.7	17.0	17.2
56	16.6	16.9	17.1
60	16.5	16.8	17.0
64	16.4	16.7	16.8
68	16.4	16.6	16.7
72	16.3	16.5	16.6
76	16.2	16.4	16.5
80	16.1	16.3	16.3
84	16.0	16.1	16.2
88	15.9	16.0	16.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	31 ′	1 ′	2 ′
0	14.6	14.3	14.2
4	14.6	14.3	14.2
8	14.6	14.3	14.2
12	14.6	14.4	14.2
16	14.7	14.4	14.3
20	14.7	14.4	14.3
24	14.7	14.5	14.4
28	14.8	14.5	14.4
32	14.8	14.6	14.5
36	14.9	14.7	14.6
40	14.9	14.8	14.7
44	15.0	14.8	14.7
48	15.1	14.9	14.8
52	15.1	15.0	15.0
56	15.2	15.1	15.1
60	15.3	15.2	15.2
64	15.4	15.3	15.3
68	15.5	15.4	15.4
72	15.5	15.5	15.5
76	15.6	15.7	15.7
80	15.7	15.8	15.8
84	15.8	15.9	15.9
88	15.9	16.0	16.0
90			

Subtract from table, back cover

Trinity Sunday 31

GMT	♈ GHA	VENUS −4.1 GHA	VENUS −4.1 Dec.	MARS 1.8 GHA	MARS 1.8 Dec.	JUPITER −1.5 GHA	JUPITER −1.5 Dec.	SATURN 0.8 GHA	SATURN 0.8 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
3 0	251 09.1	224 18.1	+ 8 51.7	169 22.2	+23 57.8	187 13.8	+20 38.4	50 50.0	− 5 41.2	289 49.0	102	−13 46.5	+138
1	266 11.6	239 18.7	52.1	184 22.8	57.9	202 15.6	38.5	65 52.6	41.1	304 18.2	102	13 32.7	+139
2	281 14.1	254 19.2	52.6	199 23.4	58.0	217 17.5	38.6	80 55.1	41.1	318 47.4	103	13 18.8	+140
3	296 16.5	269 19.8	·· 53.1	214 24.0	·· 58.1	232 19.3	·· 38.7	95 57.7	·· 41.1	333 16.7	103	·13 04.8	+140
4	311 19.0	284 20.4	53.6	229 24.6	58.2	247 21.2	38.8	111 00.2	41.1	347 46.0	104	12 50.8	+141
5	326 21.5	299 21.0	54.1	244 25.3	58.3	262 23.0	38.9	126 02.8	41.0	2 15.4	104	12 36.7	+142
6	341 23.9	314 21.6	+ 8 54.6	259 25.9	+23 58.4	277 24.9	+20 39.0	141 05.3	− 5 41.0	16 44.8	105	−12 22.5	+143
7	356 26.4	329 22.2	55.1	274 26.5	58.6	292 26.7	39.1	156 07.9	41.0	31 14.3	105	12 08.2	+143
8	11 28.9	344 22.8	55.6	289 27.1	58.7	307 28.6	39.2	171 10.4	41.0	45 43.8	106	11 53.9	+144
9	26 31.3	359 23.3	·· 56.1	304 27.7	·· 58.8	322 30.4	·· 39.4	186 12.9	·· 41.0	60 13.4	106	·11 39.5	+145
10	41 33.8	14 23.9	56.6	319 28.3	58.9	337 32.3	39.5	201 15.5	40.9	74 43.0	107	11 25.0	+145
11	56 36.3	29 24.5	57.1	334 29.0	59.0	352 34.1	39.6	216 18.0	40.9	89 12.7	107	11 10.5	+146
12	71 38.7	44 25.1	+ 8 57.5	349 29.6	+23 59.1	7 36.0	+20 39.7	231 20.6	− 5 40.9	103 42.4	108	−10 55.9	+147
13	86 41.2	59 25.7	58.0	4 30.2	59.2	22 37.8	39.8	246 23.1	40.9	118 12.2	108	10 41.2	+147
14	101 43.6	74 26.2	58.5	19 30.8	59.3	37 39.7	39.9	261 25.7	40.9	132 42.0	109	10 26.5	+148
15	116 46.1	89 26.8	·· 59.0	34 31.4	·· 59.4	52 41.5	·· 40.0	276 28.2	·· 40.8	147 11.9	109	·10 11.7	+148
16	131 48.6	104 27.4	8 59.5	49 32.1	59.5	67 43.4	40.1	291 30.8	40.8	161 41.8	110	9 56.9	+149
17	146 51.0	119 27.9	9 00.0	64 32.7	59.7	82 45.2	40.2	306 33.3	40.8	176 11.8	110	9 42.0	+149
18	161 53.5	134 28.5	+ 9 00.5	79 33.3	+23 59.8	97 47.1	+20 40.3	321 35.8	− 5 40.8	190 41.8	110	− 9 27.1	+150
19	176 56.0	149 29.1	01.0	94 33.9	23 59.9	112 48.9	40.4	336 38.4	40.7	205 11.8	111	9 12.1	+150
20	191 58.4	164 29.7	01.5	109 34.5	24 00.0	127 50.8	40.5	351 40.9	40.7	219 41.9	111	8 57.1	+151
21	207 00.9	179 30.2	·· 02.0	124 35.2	·· 00.1	142 52.6	·· 40.6	6 43.5	·· 40.7	234 12.0	111	· 8 42.0	+152
22	222 03.4	194 30.8	02.5	139 35.8	00.2	157 54.5	40.7	21 46.0	40.7	248 42.1	112	8 26.8	+151
23	237 05.8	209 31.3	03.0	154 36.4	00.3	172 56.3	40.8	36 48.6	40.7	263 12.3	113	8 11.7	+153
4 0	252 08.3	224 31.9	+ 9 03.5	169 37.0	+24 00.4	187 58.2	+20 40.9	51 51.1	− 5 40.6	277 42.6	112	− 7 56.4	+152
1	267 10.8	239 32.5	04.0	184 37.6	00.5	203 00.0	41.0	66 53.6	40.6	292 12.8	113	7 41.2	+154
2	282 13.2	254 33.0	04.6	199 38.3	00.6	218 01.9	41.1	81 56.2	40.6	306 43.1	114	7 25.8	+153
3	297 15.7	269 33.6	·· 05.1	214 38.9	·· 00.7	233 03.7	·· 41.2	96 58.7	·· 40.6	321 13.5	113	· 7 10.5	+154
4	312 18.1	284 34.1	05.6	229 39.5	00.8	248 05.6	41.3	112 01.3	40.6	335 43.8	114	6 55.1	+154
5	327 20.6	299 34.7	06.1	244 40.1	00.9	263 07.4	41.4	127 03.8	40.5	350 14.2	114	6 39.7	+155
6	342 23.1	314 35.3	+ 9 06.6	259 40.7	+24 01.0	278 09.3	+20 41.5	142 06.3	− 5 40.5	4 44.6	115	− 6 24.2	+155
7	357 25.5	329 35.8	07.1	274 41.4	01.1	293 11.1	41.6	157 08.9	40.5	19 15.1	115	6 08.7	+156
8	12 28.0	344 36.4	07.6	289 42.0	01.2	308 13.0	41.8	172 11.4	40.5	33 45.6	115	5 53.1	+155
9	27 30.5	359 36.9	·· 08.1	304 42.6	·· 01.3	323 14.8	·· 41.9	187 14.0	·· 40.5	48 16.1	115	· 5 37.6	+156
10	42 32.9	14 37.5	08.6	319 43.2	01.4	338 16.7	42.0	202 16.5	40.4	62 46.6	115	5 22.0	+157
11	57 35.4	29 38.0	09.1	334 43.8	01.5	353 18.5	42.1	217 19.0	40.4	77 17.1	116	5 06.3	+156
12	72 37.9	44 38.5	+ 9 09.6	349 44.5	+24 01.6	8 20.4	+20 42.2	232 21.6	− 5 40.4	91 47.7	116	− 4 50.7	+157
13	87 40.3	59 39.1	10.2	4 45.1	01.7	23 22.2	42.3	247 24.1	40.4	106 18.3	116	4 35.0	+157
14	102 42.8	74 39.6	10.7	19 45.7	01.8	38 24.1	42.4	262 26.7	40.4	120 48.9	116	4 19.3	+158
15	117 45.2	89 40.2	·· 11.2	34 46.3	·· 01.9	53 26.0	·· 42.5	277 29.2	·· 40.3	135 19.5	117	· 4 03.5	+157
16	132 47.7	104 40.7	11.7	49 46.9	02.0	68 27.8	42.6	292 31.8	40.3	149 50.2	117	3 47.8	+158
17	147 50.2	119 41.3	12.2	64 47.6	02.1	83 29.7	42.7	307 34.3	40.3	164 20.9	116	3 32.0	+158
18	162 52.6	134 41.8	+ 9 12.7	79 48.2	+24 02.2	98 31.5	+20 42.8	322 36.8	− 5 40.3	178 51.5	117	− 3 16.2	+158
19	177 55.1	149 42.3	13.2	94 48.8	02.3	113 33.4	42.9	337 39.4	40.3	193 22.2	117	3 00.4	+158
20	192 57.6	164 42.9	13.8	109 49.4	02.4	128 35.2	43.0	352 41.9	40.2	207 52.9	118	2 44.6	+159
21	208 00.0	179 43.4	·· 14.3	124 50.0	·· 02.5	143 37.1	·· 43.1	7 44.4	·· 40.2	222 23.7	117	· 2 28.7	+159
22	223 02.5	194 43.9	14.8	139 50.7	02.6	158 38.9	43.2	22 47.0	40.2	236 54.4	117	2 12.8	+158
23	238 05.0	209 44.5	15.3	154 51.3	02.7	173 40.8	43.3	37 49.5	40.2	251 25.1	118	1 57.0	+159
5 0	253 07.4	224 45.0	+ 9 15.8	169 51.9	+24 02.8	188 42.6	+20 43.4	52 52.1	− 5 40.2	265 55.9	117	− 1 41.1	+159
1	268 09.9	239 45.5	16.3	184 52.5	02.9	203 44.5	43.5	67 54.6	40.1	280 26.6	118	1 25.2	+159
2	283 12.4	254 46.1	16.9	199 53.2	03.0	218 46.3	43.6	82 57.1	40.1	294 57.4	117	1 09.3	+159
3	298 14.8	269 46.6	·· 17.4	214 53.8	·· 03.1	233 48.2	·· 43.7	97 59.7	·· 40.1	309 28.1	118	· 0 53.4	+160
4	313 17.3	284 47.1	17.9	229 54.4	03.2	248 50.0	43.8	113 02.2	40.1	323 58.9	117	0 37.4	+159
5	328 19.7	299 47.6	18.4	244 55.0	03.3	263 51.9	43.9	128 04.8	40.1	338 29.6	118	0 21.5	+159
6	343 22.2	314 48.2	+ 9 19.0	259 55.6	+24 03.4	278 53.7	+20 44.0	143 07.3	− 5 40.0	353 00.4	118	− 0 05.6	+159
7	358 24.7	329 48.7	19.5	274 56.3	03.5	293 55.6	44.1	158 09.8	40.0	7 31.2	117	+ 0 10.3	+160
8	13 27.1	344 49.2	20.0	289 56.9	03.6	308 57.4	44.2	173 12.4	40.0	22 01.9	118	0 26.3	+159
9	28 29.6	359 49.7	·· 20.5	304 57.5	·· 03.7	323 59.3	·· 44.3	188 14.9	·· 40.0	36 32.7	117	· 0 42.2	+159
10	43 32.1	14 50.2	21.1	319 58.1	03.8	339 01.1	44.4	203 17.4	40.0	51 03.4	117	0 58.1	+159
11	58 34.5	29 50.8	21.6	334 58.7	03.9	354 03.0	44.5	218 20.0	39.9	65 34.1	118	1 14.0	+159
12	73 37.0	44 51.3	+ 9 22.1	349 59.4	+24 04.0	9 04.8	+20 44.6	233 22.5	− 5 39.9	80 04.9	117	+ 1 29.9	+160
13	88 39.5	59 51.8	22.6	5 00.0	04.0	24 06.7	44.7	248 25.0	39.9	94 35.6	117	1 45.9	+158
14	103 41.9	74 52.3	23.2	20 00.6	04.1	39 08.5	44.8	263 27.6	39.9	109 06.3	117	2 01.7	+159
15	118 44.4	89 52.8	·· 23.7	35 01.2	·· 04.2	54 10.4	·· 44.9	278 30.1	·· 39.9	123 37.0	117	· 2 17.6	+159
16	133 46.8	104 53.3	24.2	50 01.8	04.3	69 12.2	45.1	293 32.7	39.9	138 07.7	117	2 33.5	+159
17	148 49.3	119 53.8	24.8	65 02.5	04.4	84 14.1	45.2	308 35.2	39.8	152 38.4	117	2 49.4	+158
18	163 51.8	134 54.4	+ 9 25.3	80 03.1	+24 04.5	99 15.9	+20 45.3	323 37.7	− 5 39.8	167 09.1	116	+ 3 05.2	+159
19	178 54.2	149 54.9	25.8	95 03.7	04.6	114 17.8	45.4	338 40.3	39.8	181 39.7	116	3 21.1	+158
20	193 56.7	164 55.4	26.3	110 04.3	04.7	129 19.6	45.5	353 42.8	39.8	196 10.3	116	3 36.9	+158
21	208 59.2	179 55.9	·· 26.9	125 04.9	·· 04.8	144 21.5	·· 45.6	8 45.3	·· 39.8	210 40.9	116	· 3 52.7	+157
22	224 01.6	194 56.4	27.4	140 05.6	04.9	159 23.3	45.7	23 47.9	39.7	225 11.5	116	4 08.4	+158
23	239 04.1	209 56.9	27.9	155 06.2	04.9	174 25.2	45.8	38 50.4	39.7	239 42.1	116	4 24.2	+157
24	254 06.6	224 57.4	+ 9 28.5	170 06.8	+24 05.0	189 27.0	+20 45.9	53 52.9	− 5 39.7	254 12.7	115	+ 4 39.9	+157
code	−	+ 6	+ 6	+ 6	+ 1	+ 18	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
3 0	180 31.7	+22 15.1
1	195 31.6	15.4
2	210 31.5	15.7
3	225 31.4	16.0
4	240 31.3	16.3
5	255 31.2	16.7
6	270 31.1	+22 17.0
7	285 31.0	17.3
8	300 30.9	17.6
9	315 30.8	17.9
10	330 30.7	18.2
11	345 30.6	18.5
12	0 30.5	+22 18.8
13	15 30.4	19.1
14	30 30.3	19.4
15	45 30.2	19.7
16	60 30.1	20.1
17	75 30.0	20.4
18	90 29.9	+22 20.7
19	105 29.8	21.0
20	120 29.7	21.3
21	135 29.6	21.6
22	150 29.5	21.9
23	165 29.4	22.2
4 0	180 29.3	+22 22.5
1	195 29.2	22.8
2	210 29.1	23.1
3	225 29.0	23.4
4	240 28.8	23.7
5	255 28.7	24.0
6	270 28.6	+22 24.3
7	285 28.5	24.6
8	300 28.4	24.9
9	315 28.3	25.1
10	330 28.2	25.4
11	345 28.1	25.7
12	0 28.0	+22 26.0
13	15 27.9	26.3
14	30 27.8	26.6
15	45 27.7	26.9
16	60 27.6	27.2
17	75 27.5	27.5
18	90 27.4	+22 27.8
19	105 27.3	28.1
20	120 27.2	28.3
21	135 27.0	28.6
22	150 26.9	28.9
23	165 26.8	29.2
5 0	180 26.7	+22 29.5
1	195 26.6	29.8
2	210 26.5	30.0
3	225 26.4	30.3
4	240 26.3	30.6
5	255 26.2	30.9
6	270 26.1	+22 31.2
7	285 26.0	31.4
8	300 25.9	31.7
9	315 25.7	32.0
10	330 25.6	32.3
11	345 25.5	32.6
12	0 25.4	+22 32.8
13	15 25.3	33.1
14	30 25.2	33.4
15	45 25.1	33.7
16	60 25.0	33.9
17	75 24.9	34.2
18	90 24.8	+22 34.5
19	105 24.6	34.7
20	120 24.5	35.0
21	135 24.4	35.3
22	150 24.3	35.5
23	165 24.2	35.8
24	180 24.1	+22 36.1
code	—	+ 3

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.2
5	Achernar	336 00.4	−57 28.1
30	Acrux	173 59.7	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.7	+56 12.9
34	Alkaid	153 33.8	+49 32.8
55	Al Na'ir	28 40.0	−47 11.0
15	Alnilam	276 32.4	− 1 13.8
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.7	+26 52.1
1	Alpheratz	358 30.3	+28 49.9
51	Altair	62 51.9	+ 8 44.5
2	Ankaa	354 00.1	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.0	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.6	+45 57.3
53	Deneb	50 02.0	+45 06.6
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.1	−18 14.4
27	Dubhe	194 46.6	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.5	+51 29.5
54	Enif	34 31.2	+ 9 39.6
56	Fomalhaut	16 13.5	−29 52.0
31	Gacrux	172 51.2	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 52.0	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.5	+74 20.8
57	Markab	14 23.2	+14 57.2
8	Menkar	315 02.5	+ 3 54.6
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.1	−69 31.8
9	Mirfak	309 45.5	+49 41.8
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.6	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.0
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.4	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.9
49	Vega	81 09.1	+38 44.2
39	Zub'g'bi	137 55.1	−15 51.2

Lat.	Sunrise	Twlt. begins	Moonrise 3	4	5	6
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	1 55	1 11	0 38	{0 07 / 23 31}
70	▭	▭	1 30	1 00	0 36	{0 13 / 23 47}
68	▭	▭	1 11	0 51	0 34	0 18
66	1 00	////	0 56	0 44	0 33	0 22
64	1 51	////	0 43	0 37	0 31	0 26
62	2 22	////	0 32	0 31	0 30	0 29
60	2 45	////	0 23	0 26	0 29	0 32
58	3 04	////	0 15	0 22	0 29	0 35
56	3 19	////	0 07	0 18	0 28	0 37
54	3 32	////	0 01	0 15	0 27	0 39
52	3 44	////	24 12	0 12	0 26	0 41
50	3 54	////	24 09	0 09	0 26	0 42
45	4 15	1 50	24 02	0 02	0 24	0 46
40	4 32	2 33	23 57	24 23	0 23	0 49
35	4 46	3 02	23 52	24 22	0 22	0 52
30	4 59	3 24	23 48	24 21	0 21	0 54
20	5 20	3 57	23 41	24 20	0 20	0 59
10	5 38	4 21	23 35	24 19	0 19	1 02
0	5 55	4 39	23 29	24 18	0 18	1 06
10	6 11	4 56	23 23	24 16	0 16	1 10
20	6 29	5 10	23 17	24 15	0 15	1 14
30	6 49	5 23	23 09	24 14	0 14	1 18
35	7 01	5 30	23 05	24 13	0 13	1 21
40	7 14	5 36	23 00	24 12	0 12	1 24
45	7 30	5 43	22 55	24 11	0 11	1 27
50	7 50	5 51	22 48	24 10	0 10	1 31
52	7 59	5 54	22 45	24 09	0 09	1 33
54	8 09	5 57	22 42	24 09	0 09	1 36
56	8 21	6 01	22 38	24 08	0 08	1 38
58	8 35	6 04	22 34	24 07	0 07	1 41
60	8 51	6 08	22 29	24 06	0 06	1 44
S						

Lat.	Sunset	Twlt. ends	Moonset 3	4	5	6
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	8 14	10 43	13 01	15 23
70	▭	▭	8 37	10 51	12 59	15 09
68	▭	▭	8 54	10 58	12 57	14 58
66	23 01	////	9 08	11 03	12 56	14 49
64	22 07	////	9 19	11 08	12 54	14 42
62	21 36	////	9 28	11 12	12 53	14 35
60	21 12	////	9 36	11 15	12 52	14 30
58	20 53	////	9 43	11 18	12 51	14 25
56	20 38	////	9 50	11 20	12 50	14 21
54	20 25	////	9 55	11 23	12 50	14 17
52	20 13	////	10 00	11 25	12 49	14 13
50	20 03	////	10 05	11 27	12 48	14 10
45	19 42	22 09	10 14	11 31	12 47	14 04
40	19 25	21 25	10 22	11 35	12 46	13 58
35	19 10	20 55	10 29	11 37	12 45	13 53
30	18 58	20 33	10 35	11 40	12 44	13 49
20	18 37	20 00	10 45	11 45	12 43	13 42
10	18 19	19 36	10 54	11 48	12 42	13 35
0	18 02	19 17	11 03	11 52	12 40	13 29
10	17 45	19 00	11 11	11 55	12 39	13 23
20	17 28	18 46	11 20	11 59	12 38	13 17
30	17 07	18 32	11 29	12 03	12 36	13 10
35	16 56	18 26	11 35	12 06	12 35	13 06
40	16 42	18 19	11 41	12 09	12 35	13 01
45	16 26	18 12	11 49	12 12	12 33	12 55
50	16 07	18 05	11 57	12 15	12 32	12 49
52	15 57	18 01	12 01	12 17	12 31	12 46
54	15 47	17 58	12 06	12 19	12 31	12 43
56	15 35	17 55	12 11	12 21	12 30	12 39
58	15 22	17 52	12 16	12 23	12 29	12 35
60	15 06	17 48	12 22	12 25	12 28	12 31
S						

GMT	Equation of Time (App.—Mean) 3	4	5
h	m s	m s	m s
0	+ 2 07.1	+ 1 57.3	+ 1 47.1
6	+ 2 04.6	+ 1 54.8	+ 1 44.5
12	+ 2 02.2	+ 1 52.2	+ 1 41.9
18	+ 1 59.7	+ 1 49.7	+ 1 39.2
24	+ 1 57.3	+ 1 47.1	+ 1 36.6

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
3	4 51	9 02	12 42	11 30	20 33
4	5 40	9 02	12 41	11 27	20 29
5	6 29	9 01	12 40	11 24	20 25
6	7 18	9 00	12 39	11 21	20 21

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.3	0.1
30	0.1	0.2	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	3	4	5
°	′	′	′
0	18.3	18.5	18.5
4	18.3	18.5	18.5
8	18.3	18.4	18.4
12	18.3	18.4	18.4
16	18.2	18.4	18.4
20	18.2	18.3	18.3
24	18.1	18.2	18.2
28	18.1	18.2	18.2
32	18.0	18.1	18.1
36	17.9	18.0	18.0
40	17.8	17.9	17.9
44	17.7	17.8	17.8
48	17.6	17.7	17.7
52	17.4	17.5	17.5
56	17.3	17.4	17.4
60	17.2	17.3	17.3
64	17.0	17.1	17.1
68	16.9	17.0	17.0
72	16.8	16.8	16.8
76	16.6	16.7	16.7
80	16.5	16.5	16.5
84	16.3	16.3	16.3
88	16.2	16.2	16.2
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	3	4	5
°	′	′	′
0	14.0	13.9	13.9
4	14.0	13.9	13.9
8	14.0	13.9	13.9
12	14.0	13.9	13.9
16	14.1	14.0	14.0
20	14.1	14.0	14.0
24	14.2	14.1	14.1
28	14.2	14.2	14.2
32	14.3	14.3	14.3
36	14.4	14.4	14.4
40	14.5	14.5	14.5
44	14.6	14.6	14.6
48	14.7	14.7	14.7
52	14.9	14.8	14.8
56	15.0	15.0	15.0
60	15.1	15.1	15.1
64	15.3	15.2	15.2
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.8	15.9	15.9
84	16.0	16.0	16.0
88	16.1	16.1	16.1
90			

Subtract from table, back cover

Corpus Christi 4
Last Quarter 4

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
6 0	254 06.6	224 57.4	+ 9 28.5	170 06.8	+24 05.0	189 27.0	+20 45.9	53 52.9	− 5 39.7	254 12.7	115	+ 4 39.9	+157
1	269 09.0	239 57.9	29.0	185 07.4	05.1	204 28.9	46.0	68 55.5	39.7	268 43.2	115	4 55.6	+157
2	284 11.5	254 58.4	29.5	200 08.0	05.2	219 30.7	46.1	83 58.0	39.7	283 13.7	114	5 11.3	+157
3	299 14.0	269 58.9	30.1	215 08.7	05.3	234 32.6	46.2	99 00.5	39.7	297 44.1	115	5 27.0	+156
4	314 16.4	284 59.4	30.6	230 09.3	05.4	249 34.4	46.3	114 03.1	39.6	312 14.6	114	5 42.6	+156
5	329 18.9	299 59.9	31.2	245 09.9	05.5	264 36.3	46.4	129 05.6	39.6	326 45.0	114	5 58.2	+156
6	344 21.3	315 00.4	+ 9 31.7	260 10.5	+24 05.6	279 38.1	+20 46.5	144 08.2	− 5 39.6	341 15.4	114	+ 6 13.8	+155
7	359 23.8	330 00.9	32.2	275 11.1	05.6	294 40.0	46.6	159 10.7	39.6	355 45.8	113	6 29.3	+155
8	14 26.3	345 01.3	32.8	290 11.8	05.7	309 41.8	46.7	174 13.2	39.6	10 16.1	113	6 44.8	+154
9	29 28.7	0 01.8	33.3	305 12.4	05.8	324 43.7	46.8	189 15.8	39.6	24 46.4	112	7 00.2	+155
10	44 31.2	15 02.3	33.8	320 13.0	05.9	339 45.5	46.9	204 18.3	39.5	39 16.6	113	7 15.7	+154
11	59 33.7	30 02.8	34.4	335 13.6	06.0	354 47.4	47.0	219 20.8	39.5	53 46.9	112	7 31.1	+153
12	74 36.1	45 03.3	+ 9 34.9	350 14.3	+24 06.1	9 49.2	+20 47.1	234 23.4	− 5 39.5	68 17.1	111	+ 7 46.4	+153
13	89 38.6	60 03.8	35.5	5 14.9	06.1	24 51.1	47.2	249 25.9	39.5	82 47.2	111	8 01.7	+153
14	104 41.1	75 04.3	36.0	20 15.5	06.2	39 52.9	47.3	264 28.4	39.5	97 17.3	111	8 17.0	+152
15	119 43.5	90 04.8	36.6	35 16.1	06.3	54 54.8	47.4	279 30.9	39.4	111 47.4	110	8 32.2	+151
16	134 46.0	105 05.2	37.1	50 16.7	06.4	69 56.6	47.5	294 33.5	39.4	126 17.4	110	8 47.3	+152
17	149 48.5	120 05.7	37.6	65 17.4	06.5	84 58.5	47.6	309 36.0	39.4	140 47.4	110	9 02.5	+150
18	164 50.9	135 06.2	+ 9 38.2	80 18.0	+24 06.6	100 00.3	+20 47.7	324 38.5	− 5 39.4	155 17.4	109	+ 9 17.5	+150
19	179 53.4	150 06.7	38.7	95 18.6	06.6	115 02.2	47.8	339 41.1	39.4	169 47.3	108	9 32.5	+150
20	194 55.8	165 07.1	39.3	110 19.2	06.7	130 04.0	47.9	354 43.6	39.4	184 17.1	109	9 47.5	+149
21	209 58.3	180 07.6	39.8	125 19.8	06.8	145 05.9	48.0	9 46.1	39.3	198 47.0	107	10 02.4	+149
22	225 00.8	195 08.1	40.4	140 20.5	06.9	160 07.7	48.1	24 48.7	39.3	213 16.7	108	10 17.3	+148
23	240 03.2	210 08.6	40.9	155 21.1	07.0	175 09.6	48.2	39 51.2	39.3	227 46.5	106	10 32.1	+147
7 0	255 05.7	225 09.0	+ 9 41.5	170 21.7	+24 07.0	190 11.4	+20 48.3	54 53.7	− 5 39.3	242 16.1	107	+10 46.8	+147
1	270 08.2	240 09.5	42.0	185 22.3	07.1	205 13.3	48.4	69 56.3	39.3	256 45.8	105	11 01.5	+146
2	285 10.6	255 10.0	42.6	200 23.0	07.2	220 15.1	48.5	84 58.8	39.3	271 15.3	106	11 16.1	+146
3	300 13.1	270 10.5	43.1	215 23.6	07.3	235 17.0	48.6	100 01.3	39.3	285 44.9	104	+11 30.7	+145
4	315 15.6	285 10.9	43.7	230 24.2	07.3	250 18.8	48.7	115 03.9	39.2	300 14.3	105	11 45.2	+144
5	330 18.0	300 11.4	44.2	245 24.8	07.4	265 20.7	48.8	130 06.4	39.2	314 43.8	103	11 59.6	+144
6	345 20.5	315 11.9	+ 9 44.8	260 25.4	+24 07.5	280 22.5	+20 48.9	145 08.9	− 5 39.2	329 13.1	103	+12 14.0	+143
7	0 22.9	330 12.3	45.3	275 26.1	07.6	295 24.4	49.0	160 11.5	39.2	343 42.4	103	12 28.3	+142
8	15 25.4	345 12.8	45.9	290 26.7	07.7	310 26.2	49.1	175 14.0	39.2	358 11.7	102	12 42.5	+142
9	30 27.9	0 13.2	46.4	305 27.3	07.7	325 28.1	49.2	190 16.5	39.2	12 40.9	101	+12 56.7	+141
10	45 30.3	15 13.7	47.0	320 27.9	07.8	340 29.9	49.3	205 19.0	39.1	27 10.0	101	13 10.8	+140
11	60 32.8	30 14.2	47.5	335 28.5	07.9	355 31.8	49.4	220 21.6	39.1	41 39.1	100	13 24.8	+139
12	75 35.3	45 14.6	+ 9 48.1	350 29.2	+24 08.0	10 33.6	+20 49.5	235 24.1	− 5 39.1	56 08.1	100	+13 38.7	+138
13	90 37.7	60 15.1	48.6	5 29.8	08.0	25 35.5	49.6	250 26.6	39.1	70 37.1	99	13 52.5	+138
14	105 40.2	75 15.5	49.2	20 30.4	08.1	40 37.3	49.7	265 29.2	39.1	85 06.0	99	14 06.3	+137
15	120 42.7	90 16.0	49.7	35 31.0	08.2	55 39.2	49.8	280 31.7	39.1	99 34.9	97	+14 20.0	+136
16	135 45.1	105 16.4	50.3	50 31.7	08.2	70 41.0	49.9	295 34.2	39.0	114 03.6	98	14 33.6	+136
17	150 47.6	120 16.9	50.9	65 32.3	08.3	85 42.9	50.0	310 36.8	39.0	128 32.4	96	14 47.2	+134
18	165 50.1	135 17.3	+ 9 51.4	80 32.9	+24 08.4	100 44.7	+20 50.1	325 39.3	− 5 39.0	143 01.0	96	+15 00.6	+134
19	180 52.5	150 17.8	52.0	95 33.5	08.5	115 46.6	50.2	340 41.8	39.0	157 29.6	96	15 14.0	+132
20	195 55.0	165 18.2	52.5	110 34.1	08.5	130 48.4	50.3	355 44.3	39.0	171 58.2	94	15 27.2	+132
21	210 57.4	180 18.7	53.1	125 34.8	08.6	145 50.3	50.4	10 46.9	39.0	186 26.6	94	+15 40.4	+131
22	225 59.9	195 19.1	53.7	140 35.4	08.7	160 52.1	50.5	25 49.4	39.0	200 55.0	94	15 53.5	+130
23	241 02.4	210 19.6	54.2	155 36.0	08.8	175 54.0	50.6	40 51.9	38.9	215 23.4	93	16 06.5	+129
8 0	256 04.8	225 20.0	+ 9 54.8	170 36.6	+24 08.8	190 55.8	+20 50.7	55 54.5	− 5 38.9	229 51.7	92	+16 19.4	+128
1	271 07.3	240 20.5	55.3	185 37.3	08.9	205 57.7	50.8	70 57.0	38.9	244 19.9	91	16 32.2	+127
2	286 09.8	255 20.9	55.9	200 37.9	09.0	220 59.5	50.9	85 59.5	38.9	258 48.0	91	16 44.9	+126
3	301 12.2	270 21.4	56.5	215 38.5	09.0	236 01.4	51.0	101 02.0	38.9	273 16.1	90	+16 57.5	+125
4	316 14.7	285 21.8	57.0	230 39.1	09.1	251 03.3	51.1	116 04.6	38.9	287 44.1	89	17 10.0	+124
5	331 17.2	300 22.2	57.6	245 39.8	09.2	266 05.1	51.2	131 07.1	38.9	302 12.0	89	17 22.4	+123
6	346 19.6	315 22.7	+ 9 58.1	260 40.4	+24 09.2	281 07.0	+20 51.3	146 09.6	− 5 38.8	316 39.9	88	+17 34.7	+122
7	1 22.1	330 23.1	58.7	275 41.0	09.3	296 08.8	51.4	161 12.1	38.8	331 07.7	88	17 46.9	+121
8	16 24.6	345 23.5	59.3	290 41.6	09.4	311 10.7	51.5	176 14.7	38.8	345 35.5	86	17 59.0	+120
9	31 27.0	0 24.0	+ 9 59.8	305 42.2	09.4	326 12.5	51.6	191 17.2	38.8	0 03.1	87	+18 11.0	+119
10	46 29.5	15 24.4	10 00.4	320 42.9	09.5	341 14.4	51.7	206 19.7	38.8	14 30.8	85	18 22.9	+117
11	61 31.9	30 24.8	01.0	335 43.5	09.6	356 16.2	51.8	221 22.2	38.8	28 58.3	85	18 34.6	+117
12	76 34.4	45 25.3	+10 01.5	350 44.1	+24 09.6	11 18.1	+20 51.9	236 24.8	− 5 38.8	43 25.8	84	+18 46.3	+115
13	91 36.9	60 25.7	02.1	5 44.7	09.7	26 19.9	52.0	251 27.3	38.7	57 53.2	83	18 57.8	+115
14	106 39.3	75 26.1	02.7	20 45.4	09.8	41 21.8	52.1	266 29.8	38.7	72 20.5	83	19 09.3	+113
15	121 41.8	90 26.6	03.2	35 46.0	09.8	56 23.6	52.2	281 32.4	38.7	86 47.8	82	+19 20.6	+112
16	136 44.3	105 27.0	03.8	50 46.6	09.9	71 25.5	52.3	296 34.9	38.7	101 15.0	81	19 31.8	+111
17	151 46.7	120 27.4	04.4	65 47.2	10.0	86 27.3	52.4	311 37.4	38.7	115 42.1	80	19 42.9	+109
18	166 49.2	135 27.8	+10 04.9	80 47.8	+24 10.0	101 29.2	+20 52.5	326 39.9	− 5 38.7	130 09.1	80	+19 53.8	+109
19	181 51.7	150 28.3	05.5	95 48.5	10.1	116 31.0	52.6	341 42.5	38.7	144 36.1	80	20 04.7	+107
20	196 54.1	165 28.7	06.1	110 49.1	10.2	131 32.9	52.7	356 45.0	38.6	159 03.1	78	20 15.4	+106
21	211 56.6	180 29.1	06.7	125 49.7	10.2	146 34.7	52.8	11 47.5	38.6	173 29.9	78	+20 26.0	+104
22	226 59.1	195 29.5	07.2	140 50.3	10.3	161 36.6	52.9	26 50.0	38.6	187 56.7	78	20 36.4	+104
23	242 01.5	210 29.9	07.8	155 51.0	10.3	176 38.4	53.0	41 52.6	38.6	202 23.5	76	20 46.8	+102
24	257 04.0	225 30.4	+10 08.4	170 51.6	+24 10.4	191 40.3	+20 53.1	56 55.1	− 5 38.6	216 50.1	76	+20 57.0	+100
code	−	+ 5	+ 5	+ 6	0	+ 19	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
6 0	180 24.1	+22 36.1
1	195 24.0	36.4
2	210 23.9	36.6
3	225 23.8	36.9
4	240 23.6	37.1
5	255 23.5	37.4
6	270 23.4	+22 37.7
7	285 23.3	37.9
8	300 23.2	38.2
9	315 23.1	38.5
10	330 23.0	38.7
11	345 22.9	39.0
12	0 22.7	+22 39.2
13	15 22.6	39.5
14	30 22.5	39.8
15	45 22.4	40.0
16	60 22.3	40.3
17	75 22.2	40.5
18	90 22.1	+22 40.8
19	105 21.9	41.0
20	120 21.8	41.3
21	135 21.7	41.5
22	150 21.6	41.8
23	165 21.5	42.0
7 0	180 21.4	+22 42.3
1	195 21.3	42.5
2	210 21.1	42.8
3	225 21.0	43.0
4	240 20.9	43.3
5	255 20.8	43.5
6	270 20.7	+22 43.8
7	285 20.6	44.0
8	300 20.4	44.3
9	315 20.3	44.5
10	330 20.2	44.8
11	345 20.1	45.0
12	0 20.0	+22 45.3
13	15 19.9	45.5
14	30 19.7	45.7
15	45 19.6	46.0
16	60 19.5	46.2
17	75 19.4	46.5
18	90 19.3	+22 46.7
19	105 19.2	46.9
20	120 19.0	47.2
21	135 18.9	47.4
22	150 18.8	47.6
23	165 18.7	47.9
8 0	180 18.6	+22 48.1
1	195 18.5	48.3
2	210 18.3	48.6
3	225 18.2	48.8
4	240 18.1	49.0
5	255 18.0	49.3
6	270 17.9	+22 49.5
7	285 17.7	49.7
8	300 17.6	50.0
9	315 17.5	50.2
10	330 17.4	50.4
11	345 17.3	50.6
12	0 17.1	+22 50.9
13	15 17.0	51.1
14	30 16.9	51.3
15	45 16.8	51.5
16	60 16.7	51.8
17	75 16.5	52.0
18	90 16.4	+22 52.2
19	105 16.3	52.4
20	120 16.2	52.7
21	135 16.1	52.9
22	150 15.9	53.1
23	165 15.8	53.3
24	180 15.7	+22 53.5
code	—	+ 2

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.8	−40 29.2
5	Achernar	336 00.4	−57 28.0
30	Acrux	173 59.8	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.5	+16 25.1
32	Alioth	166 59.7	+56 12.9
34	Alkaid	153 33.8	+49 32.8
55	Al Na'ir	28 39.9	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.7	+26 52.1
1	Alpheratz	358 30.3	+28 49.9
51	Altair	62 51.9	+ 8 44.5
2	Ankaa	354 00.1	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.1	−59 21.8
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.5	+45 57.3
53	Deneb	50 02.0	+45 06.6
28	Denebola	183 19.4	+14 49.9
4	Diphda	349 41.1	−18 14.3
27	Dubhe	194 46.6	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.5	+51 29.5
54	Enif	34 31.2	+ 9 39.6
56	Fomalhaut	16 13.5	−29 52.0
31	Gacrux	172 51.2	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 51.9	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.5	+74 20.8
57	Markab	14 23.2	+14 57.2
8	Menkar	315 02.5	+ 3 54.6
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.1	−69 31.8
9	Mirfak	309 45.5	+49 41.8
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.6	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.1
44	Sabik	103 03.9	−15 40.3
3	Schedar	350 32.4	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.9	−43 14.8
49	Vega	81 09.1	+38 44.2
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 6	7	8
h	m s	m s	m s
0	+ 1 36.6	+ 1 25.7	+ 1 14.5
6	+ 1 33.9	+ 1 22.9	+ 1 11.7
12	+ 1 31.2	+ 1 20.2	+ 1 08.8
18	+ 1 28.5	+ 1 17.3	+ 1 05.9
24	+ 1 25.7	+ 1 14.5	+ 1 03.1

Lat.	Sunrise	Twlt. begins	Moonrise 6	7	8	9
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	{0 07 / 23 31}	22 34	▭	▭
70	▭	▭	{0 13 / 23 47}	23 11	▭	▭
68	▭	▭	0 18	{0 00 / 23 38}	22 56	▭
66	0 46	////	0 22	{0 11 / 23 58}	23 39	▭
64	1 45	////	0 26	0 21	0 15	{0 08 / 23 59}
62	2 18	////	0 29	0 29	0 29	0 30
60	2 42	////	0 32	0 35	0 40	0 49
58	3 01	////	0 35	0 42	0 51	1 04
56	3 17	////	0 37	0 47	1 00	1 17
54	3 30	////	0 39	0 52	1 08	1 28
52	3 42	////	0 41	0 56	1 15	1 38
50	3 52	////	0 42	1 00	1 21	1 47
45	4 14	1 46	0 46	1 09	1 35	2 07
40	4 31	2 31	0 49	1 17	1 47	2 22
35	4 46	3 00	0 52	1 23	1 57	2 36
30	4 58	3 23	0 54	1 29	2 06	2 47
20	5 20	3 57	0 59	1 38	2 21	3 07
10	5 38	4 21	1 02	1 47	2 34	3 25
0	5 55	4 40	1 06	1 56	2 47	3 42
10	6 12	4 56	1 10	2 04	3 00	3 58
20	6 30	5 11	1 14	2 13	3 14	4 16
30	6 50	5 25	1 18	2 23	3 30	4 37
35	7 02	5 32	1 21	2 29	3 39	4 49
40	7 16	5 38	1 24	2 36	3 50	5 03
45	7 32	5 45	1 27	2 44	4 02	5 20
50	7 52	5 53	1 31	2 54	4 18	5 41
52	8 02	5 56	1 33	2 59	4 25	5 51
54	8 12	5 59	1 36	3 04	4 33	6 02
56	8 24	6 03	1 38	3 09	4 42	6 15
58	8 38	6 07	1 41	3 15	4 52	6 30
60 S	8 55	6 10	1 44	3 23	5 04	6 48

Lat.	Sunset	Twlt. ends	Moonset 6	7	8	9
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	15 23	18 08	▭	▭
70	▭	▭	15 09	17 32	▭	▭
68	▭	▭	14 58	17 08	19 42	▭
66	23 17	////	14 49	16 48	19 00	▭
64	22 14	////	14 42	16 33	18 31	20 39
62	21 41	////	14 35	16 21	18 10	20 01
60	21 17	////	14 30	16 10	17 53	19 35
58	20 57	////	14 25	16 01	17 38	19 14
56	20 41	////	14 21	15 53	17 26	18 57
54	20 28	////	14 17	15 46	17 15	18 42
52	20 16	////	14 13	15 39	17 06	18 30
50	20 06	////	14 10	15 33	16 57	18 19
45	19 44	22 13	14 04	15 21	16 39	17 56
40	19 27	21 28	13 58	15 11	16 25	17 38
35	19 12	20 58	13 53	15 02	16 12	17 22
30	18 59	20 35	13 49	14 55	16 02	17 09
20	18 38	20 02	13 42	14 42	15 43	16 46
10	18 20	19 37	13 35	14 30	15 28	16 27
0	18 02	19 17	13 29	14 20	15 13	16 09
10	17 46	19 01	13 23	14 09	14 58	15 50
20	17 28	18 46	13 17	13 58	14 42	15 31
30	17 07	18 32	13 10	13 45	14 24	15 09
35	16 55	18 25	13 06	13 38	14 14	14 56
40	16 41	18 18	13 01	13 29	14 02	14 41
45	16 25	18 11	12 55	13 20	13 48	14 23
50	16 05	18 03	12 49	13 08	13 31	14 01
52	15 56	18 01	12 46	13 03	13 23	13 51
54	15 45	17 57	12 43	12 57	13 15	13 39
56	15 33	17 53	12 39	12 50	13 05	13 25
58	15 19	17 50	12 35	12 43	12 54	13 10
60 S	15 03	17 46	12 31	12 35	12 41	12 51

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
6	7 18	9 00	12 39	11 21	20 21
7	8 08	8 59	12 38	11 18	20 17
8	9 00	8 58	12 37	11 15	20 13
9	9 55	8 58	12 36	11 12	20 09

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.2	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	6	7	8
°	′	′	′
0	18.5	18.3	18.0
4	18.5	18.3	18.0
8	18.4	18.3	17.9
12	18.4	18.3	17.9
16	18.4	18.2	17.9
20	18.3	18.2	17.8
24	18.2	18.1	17.8
28	18.2	18.1	17.7
32	18.1	18.0	17.6
36	18.0	17.9	17.6
40	17.9	17.8	17.5
44	17.8	17.7	17.4
48	17.7	17.6	17.3
52	17.5	17.4	17.2
56	17.4	17.3	17.1
60	17.3	17.2	17.0
64	17.1	17.0	16.8
68	17.0	16.9	16.7
72	16.8	16.8	16.6
76	16.7	16.6	16.5
80	16.5	16.5	16.3
84	16.3	16.3	16.2
88	16.2	16.2	16.1
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	6	7	8
°	′	′	′
0	13.9	14.0	14.2
4	13.9	14.0	14.2
8	13.9	14.0	14.2
12	13.9	14.0	14.2
16	14.0	14.1	14.3
20	14.0	14.1	14.3
24	14.1	14.2	14.4
28	14.2	14.2	14.4
32	14.3	14.3	14.5
36	14.4	14.4	14.6
40	14.5	14.5	14.7
44	14.6	14.6	14.7
48	14.7	14.7	14.8
52	14.8	14.9	15.0
56	15.0	15.0	15.1
60	15.1	15.1	15.2
64	15.2	15.3	15.3
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.9	15.8	15.8
84	16.0	16.0	15.9
88	16.1	16.1	16.0
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.1 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
9 0	257 04.0	225 30.4	+10 08.4	170 51.6	+24 10.4	191 40.3	+20 53.1	56 55.1	− 5 38.6	216 50.1	76	+20 57.0	+100
1	272 06.4	240 30.8	08.9	185 52.2	10.5	206 42.1	53.2	71 57.6	38.6	231 16.7	75	21 07.0	+100
2	287 08.9	255 31.2	09.5	200 52.8	10.5	221 44.0	53.3	87 00.1	38.6	245 43.2	75	21 17.0	+ 98
3	302 11.4	270 31.6	•• 10.1	215 53.5	•• 10.6	236 45.8	•• 53.4	102 02.6	•• 38.6	260 09.7	74	•21 26.8	+ 97
4	317 13.8	285 32.0	10.7	230 54.1	10.6	251 47.7	53.5	117 05.2	38.5	274 36.1	74	21 36.5	+ 95
5	332 16.3	300 32.4	11.2	245 54.7	10.7	266 49.5	53.6	132 07.7	38.5	289 02.5	72	21 46.0	+ 94
6	347 18.8	315 32.8	+10 11.8	260 55.3	+24 10.8	281 51.4	+20 53.7	147 10.2	− 5 38.5	303 28.7	72	+21 55.4	+ 93
7	2 21.2	330 33.2	12.4	275 55.9	10.8	296 53.2	53.8	162 12.7	38.5	317 54.9	72	22 04.7	+ 92
8	17 23.7	345 33.7	13.0	290 56.6	10.9	311 55.1	53.9	177 15.3	38.5	332 21.1	71	22 13.9	+ 90
9	32 26.2	0 34.1	•• 13.5	305 57.2	•• 10.9	326 56.9	•• 54.0	192 17.8	•• 38.5	346 47.2	70	•22 22.9	+ 88
10	47 28.6	15 34.5	14.1	320 57.8	11.0	341 58.8	54.1	207 20.3	38.5	1 13.2	70	22 31.7	+ 87
11	62 31.1	30 34.9	14.7	335 58.4	11.1	357 00.7	54.2	222 22.8	38.4	15 39.2	69	22 40.4	+ 86
12	77 33.6	45 35.3	+10 15.3	350 59.1	+24 11.1	12 02.5	+20 54.3	237 25.4	− 5 38.4	30 05.1	69	+22 49.0	+ 84
13	92 36.0	60 35.7	15.9	5 59.7	11.2	27 04.4	54.4	252 27.9	38.4	44 31.0	68	22 57.4	+ 83
14	107 38.5	75 36.1	16.4	21 00.3	11.2	42 06.2	54.5	267 30.4	38.4	58 56.8	67	23 05.7	+ 82
15	122 40.9	90 36.5	•• 17.0	36 00.9	•• 11.3	57 08.1	•• 54.6	282 32.9	•• 38.4	73 22.5	67	•23 13.9	+ 79
16	137 43.4	105 36.9	17.6	51 01.6	11.3	72 09.9	54.7	297 35.4	38.4	87 48.2	67	23 21.8	+ 79
17	152 45.9	120 37.3	18.2	66 02.2	11.4	87 11.8	54.8	312 38.0	38.4	102 13.9	66	23 29.7	+ 77
18	167 48.3	135 37.7	+10 18.8	81 02.8	+24 11.4	102 13.6	+20 54.9	327 40.5	− 5 38.4	116 39.5	65	+23 37.4	+ 75
19	182 50.8	150 38.1	19.3	96 03.4	11.5	117 15.5	55.0	342 43.0	38.4	131 05.0	65	23 44.9	+ 74
20	197 53.3	165 38.5	19.9	111 04.1	11.6	132 17.3	55.1	357 45.5	38.3	145 30.5	64	23 52.3	+ 73
21	212 55.7	180 38.9	•• 20.5	126 04.7	•• 11.6	147 19.2	•• 55.2	12 48.1	•• 38.3	159 55.9	64	•23 59.6	+ 71
22	227 58.2	195 39.3	21.1	141 05.3	11.7	162 21.0	55.3	27 50.6	38.3	174 21.3	64	24 06.7	+ 69
23	243 00.7	210 39.7	21.7	156 05.9	11.7	177 22.9	55.4	42 53.1	38.3	188 46.7	63	24 13.6	+ 68
10 0	258 03.1	225 40.0	+10 22.2	171 06.6	+24 11.8	192 24.7	+20 55.5	57 55.6	− 5 38.3	203 12.0	62	+24 20.4	+ 66
1	273 05.6	240 40.4	22.8	186 07.2	11.8	207 26.6	55.6	72 58.1	38.3	217 37.2	63	24 27.0	+ 65
2	288 08.0	255 40.8	23.4	201 07.8	11.9	222 28.4	55.7	88 00.7	38.3	232 02.5	61	24 33.5	+ 63
3	303 10.5	270 41.2	•• 24.0	216 08.4	•• 11.9	237 30.3	•• 55.8	103 03.2	•• 38.3	246 27.6	62	•24 39.8	+ 61
4	318 13.0	285 41.6	24.6	231 09.0	12.0	252 32.1	55.9	118 05.7	38.2	260 52.8	61	24 45.9	+ 60
5	333 15.4	300 42.0	25.2	246 09.7	12.0	267 34.0	56.0	133 08.2	38.2	275 17.9	61	24 51.9	+ 59
6	348 17.9	315 42.4	+10 25.8	261 10.3	+24 12.1	282 35.8	+20 56.0	148 10.7	− 5 38.2	289 43.0	60	+24 57.8	+ 56
7	3 20.4	330 42.7	26.3	276 10.9	12.1	297 37.7	56.1	163 13.3	38.2	304 08.0	60	25 03.4	+ 56
8	18 22.8	345 43.1	26.9	291 11.5	12.2	312 39.5	56.2	178 15.8	38.2	318 33.0	60	25 09.0	+ 53
9	33 25.3	0 43.5	•• 27.5	306 12.2	•• 12.2	327 41.4	•• 56.3	193 18.3	•• 38.2	332 58.0	59	•25 14.3	+ 52
10	48 27.8	15 43.9	28.1	321 12.8	12.3	342 43.2	56.4	208 20.8	38.2	347 22.9	59	25 19.5	+ 50
11	63 30.2	30 44.3	28.7	336 13.4	12.3	357 45.1	56.5	223 23.3	38.2	1 47.8	59	25 24.5	+ 49
12	78 32.7	45 44.6	+10 29.3	351 14.0	+24 12.4	12 47.0	+20 56.6	238 25.8	− 5 38.2	16 12.7	59	+25 29.4	+ 47
13	93 35.2	60 45.0	29.9	6 14.7	12.4	27 48.8	56.7	253 28.4	38.1	30 37.6	59	25 34.1	+ 46
14	108 37.6	75 45.4	30.5	21 15.3	12.5	42 50.7	56.8	268 30.9	38.1	45 02.5	58	25 38.7	+ 43
15	123 40.1	90 45.8	•• 31.0	36 15.9	•• 12.5	57 52.5	•• 56.9	283 33.4	•• 38.1	59 27.3	58	•25 43.0	+ 42
16	138 42.5	105 46.1	31.6	51 16.5	12.6	72 54.4	57.0	298 35.9	38.1	73 52.1	58	25 47.2	+ 41
17	153 45.0	120 46.5	32.2	66 17.2	12.6	87 56.2	57.1	313 38.4	38.1	88 16.9	57	25 51.3	+ 39
18	168 47.5	135 46.9	+10 32.8	81 17.8	+24 12.7	102 58.1	+20 57.2	328 41.0	− 5 38.1	102 41.6	58	+25 55.2	+ 37
19	183 49.9	150 47.3	33.4	96 18.4	12.7	117 59.9	57.3	343 43.5	38.1	117 06.4	58	25 58.9	+ 35
20	198 52.4	165 47.6	34.0	111 19.0	12.7	133 01.8	57.4	358 46.0	38.1	131 31.2	57	26 02.4	+ 34
21	213 54.9	180 48.0	•• 34.6	126 19.7	•• 12.8	148 03.6	•• 57.5	13 48.5	•• 38.1	145 55.9	57	•26 05.8	+ 32
22	228 57.3	195 48.4	35.2	141 20.3	12.8	163 05.5	57.6	28 51.0	38.1	160 20.6	58	26 09.0	+ 31
23	243 59.8	210 48.7	35.8	156 20.9	12.9	178 07.3	57.7	43 53.5	38.0	174 45.4	57	26 12.1	+ 29
11 0	259 02.3	225 49.1	+10 36.4	171 21.5	+24 12.9	193 09.2	+20 57.8	58 56.1	− 5 38.0	189 10.1	57	+26 15.0	+ 27
1	274 04.7	240 49.5	37.0	186 22.2	13.0	208 11.0	57.9	73 58.6	38.0	203 34.8	58	26 17.7	+ 26
2	289 07.2	255 49.8	37.6	201 22.8	13.0	223 12.9	58.0	89 01.1	38.0	217 59.6	57	26 20.3	+ 23
3	304 09.7	270 50.2	•• 38.2	216 23.4	•• 13.1	238 14.7	•• 58.1	104 03.6	•• 38.0	232 24.3	57	•26 22.6	+ 23
4	319 12.1	285 50.5	38.7	231 24.0	13.1	253 16.6	58.2	119 06.1	38.0	246 49.0	58	26 24.9	+ 20
5	334 14.6	300 50.9	39.3	246 24.7	13.1	268 18.5	58.3	134 08.6	38.0	261 13.8	57	26 26.9	+ 19
6	349 17.0	315 51.3	+10 39.9	261 25.3	+24 13.2	283 20.3	+20 58.4	149 11.2	− 5 38.0	275 38.5	58	+26 28.8	+ 17
7	4 19.5	330 51.6	40.5	276 25.9	13.2	298 22.2	58.5	164 13.7	38.0	290 03.3	58	26 30.5	+ 16
8	19 22.0	345 52.0	41.1	291 26.5	13.3	313 24.0	58.6	179 16.2	38.0	304 28.1	57	26 32.1	+ 13
9	34 24.4	0 52.3	•• 41.7	306 27.2	•• 13.3	328 25.9	•• 58.7	194 18.7	•• 37.9	318 52.8	58	•26 33.4	+ 13
10	49 26.9	15 52.7	42.3	321 27.8	13.3	343 27.7	58.8	209 21.2	37.9	333 17.6	59	26 34.7	+ 10
11	64 29.4	30 53.0	42.9	336 28.4	13.4	358 29.6	58.9	224 23.7	37.9	347 42.5	58	26 35.7	+ 9
12	79 31.8	45 53.4	+10 43.5	351 29.1	+24 13.4	13 31.4	+20 59.0	239 26.2	− 5 37.9	2 07.3	59	+26 36.6	+ 7
13	94 34.3	60 53.7	44.1	6 29.7	13.5	28 33.3	59.1	254 28.8	37.9	16 32.2	59	26 37.3	+ 6
14	109 36.8	75 54.1	44.7	21 30.3	13.5	43 35.1	59.1	269 31.3	37.9	30 57.1	59	26 37.9	+ 4
15	124 39.2	90 54.4	•• 45.3	36 30.9	•• 13.5	58 37.0	•• 59.2	284 33.8	•• 37.9	45 22.0	60	•26 38.3	+ 2
16	139 41.7	105 54.8	45.9	51 31.6	13.6	73 38.8	59.3	299 36.3	37.9	59 47.0	59	26 38.5	0
17	154 44.2	120 55.1	46.5	66 32.2	13.6	88 40.7	59.4	314 38.8	37.9	74 11.9	61	26 38.5	− 1
18	169 46.6	135 55.5	+10 47.1	81 32.8	+24 13.7	103 42.5	+20 59.5	329 41.3	− 5 37.9	88 37.0	60	+26 38.4	− 2
19	184 49.1	150 55.8	47.7	96 33.4	13.7	118 44.4	59.6	344 43.9	37.9	103 02.0	61	26 38.2	− 5
20	199 51.5	165 56.2	48.3	111 34.1	13.7	133 46.2	59.7	359 46.4	37.8	117 27.1	61	26 37.7	− 6
21	214 54.0	180 56.5	•• 48.9	126 34.7	•• 13.8	148 48.1	•• 59.8	14 48.9	•• 37.8	131 52.2	62	•26 37.1	− 7
22	229 56.5	195 56.9	49.5	141 35.3	13.8	163 50.0	20 59.9	29 51.4	37.8	146 17.4	62	26 36.4	− 9
23	244 58.9	210 57.2	50.1	156 35.9	13.8	178 51.8	21 00.0	44 53.9	37.8	160 42.6	62	26 35.5	− 11
24	260 01.4	225 57.5	+10 50.7	171 36.6	+24 13.9	193 53.7	+21 00.1	59 56.4	− 5 37.8	175 07.8	63	+26 34.4	− 12
code	−	+ 4	+ 6	+ 7	0	+ 18	+ 1	+ 26	+ 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
9	0	180 15.7	+22 53.5
	1	195 15.6	53.7
	2	210 15.5	54.0
	3	225 15.3	54.2
	4	240 15.2	54.4
	5	255 15.1	54.6
	6	270 15.0	+22 54.8
	7	285 14.9	55.0
	8	300 14.7	55.2
	9	315 14.6	55.5
	10	330 14.5	55.7
	11	345 14.4	55.9
	12	0 14.2	+22 56.1
	13	15 14.1	56.3
	14	30 14.0	56.5
	15	45 13.9	56.7
	16	60 13.8	56.9
	17	75 13.6	57.1
	18	90 13.5	+22 57.3
	19	105 13.4	57.5
	20	120 13.3	57.7
	21	135 13.1	57.9
	22	150 13.0	58.1
	23	165 12.9	58.3
10	0	180 12.8	+22 58.5
	1	195 12.6	58.7
	2	210 12.5	58.9
	3	225 12.4	59.1
	4	240 12.3	59.3
	5	255 12.1	59.5
	6	270 12.0	+22 59.7
	7	285 11.9	22 59.9
	8	300 11.8	23 00.1
	9	315 11.6	00.3
	10	330 11.5	00.5
	11	345 11.4	00.7
	12	0 11.3	+23 00.9
	13	15 11.1	01.1
	14	30 11.0	01.3
	15	45 10.9	01.5
	16	60 10.8	01.7
	17	75 10.6	01.8
	18	90 10.5	+23 02.0
	19	105 10.4	02.2
	20	120 10.3	02.4
	21	135 10.1	02.6
	22	150 10.0	02.8
	23	165 09.9	03.0
11	0	180 09.8	+23 03.1
	1	195 09.6	03.3
	2	210 09.5	03.5
	3	225 09.4	03.7
	4	240 09.3	03.9
	5	255 09.1	04.1
	6	270 09.0	+23 04.2
	7	285 08.9	04.4
	8	300 08.7	04.6
	9	315 08.6	04.8
	10	330 08.5	04.9
	11	345 08.4	05.1
	12	0 08.2	+23 05.3
	13	15 08.1	05.5
	14	30 08.0	05.6
	15	45 07.9	05.8
	16	60 07.7	06.0
	17	75 07.6	06.2
	18	90 07.5	+23 06.3
	19	105 07.3	06.5
	20	120 07.2	06.7
	21	135 07.1	06.8
	22	150 07.0	07.0
	23	165 06.8	07.2
	24	180 06.7	+23 07.3
code		—	+ 2

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.7	−40 29.2
5	Achernar	336 00.3	−57 28.0
30	Acrux	173 59.8	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.7	+56 12.9
34	Alkaid	153 33.8	+49 32.8
55	Al Na'ir	28 39.9	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.7	+26 52.2
1	Alpheratz	358 30.3	+28 49.9
51	Altair	62 51.9	+ 8 44.6
2	Ankaa	354 00.0	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.1	−59 21.7
13	Bellatrix	279 20.7	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.5	+45 57.2
53	Deneb	50 02.0	+45 06.6
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.1	−18 14.3
27	Dubhe	194 46.6	+62 00.4
14	Elnath	279 10.0	+28 34.3
47	Eltanin	91 06.5	+51 29.5
54	Enif	34 31.2	+ 9 39.6
56	Fomalhaut	16 13.4	−29 52.0
31	Gacrux	172 51.2	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 51.9	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.5	+74 20.8
57	Markab	14 23.2	+14 57.2
8	Menkar	315 02.4	+ 3 54.6
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.2	−69 31.8
9	Mirfak	309 45.4	+49 41.8
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.5	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.3	+56 16.8
45	Shaula	97 22.7	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.2
39	Zub'g'bi	137 55.1	−15 51.2

GMT h	Equation of Time (App.—Mean) 9 m s	10 m s	11 m s
0	+ 1 03.1	+ 0 51.3	+ 0 39.3
6	+ 1 00.1	+ 0 48.3	+ 0 36.2
12	+ 0 57.2	+ 0 45.3	+ 0 33.2
18	+ 0 54.3	+ 0 42.3	+ 0 30.1
24	+ 0 51.3	+ 0 39.3	+ 0 27.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 9 h m	10 h m	11 h m	12 h m
72	▭	▭	▭	▭	▭	▭
70	▭	▭	▭	▭	▭	▭
68	▭	▭	▭	▭	▭	▭
66	0 29	////	▭	▭	▭	▭
64	1 39	////	0 08 / 23 59	▭	▭	▭
62	2 14	////	0 30	0 37	0 56	1 48
60	2 39	////	0 49	1 04	1 33	2 28
58	2 59	////	1 04	1 25	2 00	2 56
56	3 15	////	1 17	1 42	2 21	3 18
54	3 29	////	1 28	1 57	2 39	3 36
52	3 41	////	1 38	2 10	2 54	3 51
50	3 51	////	1 47	2 22	3 07	4 04
45	4 13	1 43	2 07	2 45	3 34	4 32
40	4 31	2 29	2 22	3 05	3 55	4 53
35	4 45	3 00	2 36	3 21	4 13	5 11
30	4 58	3 22	2 47	3 35	4 28	5 26
20	5 20	3 56	3 07	3 58	4 54	5 52
10	5 38	4 21	3 25	4 19	5 16	6 14
0	5 56	4 40	3 42	4 39	5 37	6 35
10	6 13	4 57	3 58	4 58	5 58	6 56
20	6 31	5 13	4 16	5 19	6 21	7 19
30	6 52	5 26	4 37	5 44	6 47	7 45
35	7 04	5 33	4 49	5 58	7 02	8 00
40	7 18	5 40	5 03	6 15	7 20	8 18
45	7 34	5 47	5 20	6 35	7 42	8 39
50	7 54	5 55	5 41	7 00	8 10	9 06
52	8 04	5 58	5 51	7 12	8 23	9 19
54	8 15	6 02	6 02	7 26	8 39	9 34
56	8 27	6 05	6 15	7 43	8 57	9 52
58	8 41	6 09	6 30	8 03	9 20	10 13
60	8 58	6 13	6 48	8 27	9 49	10 40
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 9 h m	10 h m	11 h m	12 h m
72	▭	▭	▭	▭	▭	▭
70	▭	▭	▭	▭	▭	▭
68	▭	▭	▭	▭	▭	▭
66	23 36	////	▭	▭	▭	▭
64	22 21	////	20 39	▭	▭	▭
62	21 45	////	20 01	21 44	22 55	23 24
60	21 20	////	19 35	21 07	22 14	22 52
58	21 01	////	19 14	20 40	21 46	22 28
56	20 44	////	18 57	20 19	21 24	22 09
54	20 31	////	18 42	20 02	21 06	21 52
52	20 18	////	18 30	19 47	20 51	21 38
50	20 08	////	18 19	19 34	20 37	21 26
45	19 46	22 17	17 56	19 08	20 10	21 01
40	19 28	21 30	17 38	18 47	19 48	20 41
35	19 13	20 59	17 22	18 29	19 31	20 24
30	19 01	20 37	17 09	18 14	19 15	20 09
20	18 39	20 03	16 46	17 49	18 49	19 44
10	18 20	19 37	16 27	17 27	18 26	19 23
0	18 03	19 18	16 09	17 07	18 05	19 02
10	17 46	19 01	15 50	16 46	17 44	18 42
20	17 28	18 46	15 31	16 24	17 21	18 20
30	17 07	18 32	15 09	15 59	16 55	17 55
35	16 55	18 25	14 56	15 44	16 39	17 40
40	16 41	18 18	14 41	15 29	16 21	17 23
45	16 24	18 10	14 23	15 06	15 59	17 01
50	16 04	18 03	14 01	14 40	15 32	16 35
52	15 54	17 59	13 51	14 28	15 18	16 22
54	15 44	17 57	13 39	14 13	15 03	16 07
56	15 31	17 52	13 25	13 57	14 44	15 50
58	15 17	17 49	13 10	13 37	14 22	15 29
60	15 00	17 44	12 51	13 12	13 53	15 01
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
9	9 55	8 58	12 36	11 12	20 09
10	10 53	8 57	12 35	11 09	20 05
11	11 51	8 57	12 34	11 06	20 01
12	12 49	8 56	12 33	11 03	19 57

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	9 ′	10 ′	11 ′
0	17.6	16.9	16.2
4	17.6	16.9	16.2
8	17.6	16.9	16.2
12	17.5	16.9	16.2
16	17.5	16.9	16.2
20	17.5	16.9	16.2
24	17.4	16.8	16.1
28	17.4	16.8	16.1
32	17.3	16.8	16.1
36	17.2	16.7	16.1
40	17.2	16.7	16.1
44	17.1	16.6	16.0
48	17.0	16.6	16.0
52	16.9	16.5	16.0
56	16.8	16.4	16.0
60	16.7	16.4	15.9
64	16.6	16.3	15.9
68	16.5	16.2	15.9
72	16.4	16.2	15.8
76	16.3	16.1	15.8
80	16.2	16.0	15.8
84	16.1	15.9	15.7
88	16.0	15.9	15.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	9 ′	10 ′	11 ′
0	14.4	14.8	15.2
4	14.4	14.8	15.2
8	14.4	14.8	15.2
12	14.4	14.8	15.2
16	14.5	14.8	15.2
20	14.5	14.8	15.2
24	14.5	14.9	15.2
28	14.6	14.9	15.3
32	14.7	14.9	15.3
36	14.7	15.0	15.3
40	14.8	15.0	15.3
44	14.9	15.1	15.3
48	15.0	15.1	15.4
52	15.0	15.2	15.4
56	15.1	15.3	15.4
60	15.2	15.3	15.5
64	15.3	15.4	15.5
68	15.4	15.5	15.5
72	15.5	15.5	15.5
76	15.7	15.6	15.6
80	15.8	15.7	15.6
84	15.9	15.8	15.7
88	16.0	15.8	15.7
90			

Subtract from table, back cover

New Moon 11

GMT	♈ GHA	VENUS −4.0 GHA	VENUS −4.0 Dec.	MARS 1.8 GHA	MARS 1.8 Dec.	JUPITER −1.5 GHA	JUPITER −1.5 Dec.	SATURN 0.8 GHA	SATURN 0.8 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
12 0	260 01.4	225 57.5	+10 50.7	171 36.6	+24 13.9	193 53.7	+21 00.1	59 56.4	− 5 37.8	175 07.8	63	+26 34.4	− 12
1	275 03.9	240 57.9	51.3	186 37.2	13.9	208 55.5	00.2	74 58.9	37.8	189 33.1	64	26 33.2	− 14
2	290 06.3	255 58.2	51.9	201 37.8	13.9	223 57.4	00.3	90 01.4	37.8	203 58.5	64	26 31.8	− 16
3	305 08.8	270 58.6	•• 52.5	216 38.4	•• 14.0	238 59.2	•• 00.4	105 04.0	•• 37.8	218 23.9	64	•26 30.2	− 17
4	320 11.3	285 58.9	53.1	231 39.1	14.0	254 01.1	00.5	120 06.5	37.8	232 49.3	65	26 28.5	− 19
5	335 13.7	300 59.2	53.7	246 39.7	14.0	269 02.9	00.6	135 09.0	37.8	247 14.8	66	26 26.6	− 20
6	350 16.2	315 59.6	+10 54.3	261 40.3	+24 14.1	284 04.8	+21 00.7	150 11.5	− 5 37.8	261 40.4	66	+26 24.6	− 22
7	5 18.6	330 59.9	54.9	276 41.0	14.1	299 06.6	00.8	165 14.0	37.8	276 06.0	67	26 22.4	− 23
8	20 21.1	346 00.2	55.5	291 41.6	14.1	314 08.5	00.9	180 16.5	37.7	290 31.7	67	26 20.1	− 25
9	35 23.6	1 00.6	•• 56.2	306 42.2	•• 14.2	329 10.3	•• 01.0	195 19.0	•• 37.7	304 57.4	68	•26 17.6	− 27
10	50 26.0	16 00.9	56.8	321 42.8	14.2	344 12.2	01.1	210 21.5	37.7	319 23.2	68	26 14.9	− 28
11	65 28.5	31 01.2	57.4	336 43.5	14.2	359 14.0	01.2	225 24.1	37.7	333 49.0	70	26 12.1	− 29
12	80 31.0	46 01.5	+10 58.0	351 44.1	+24 14.3	14 15.9	+21 01.3	240 26.6	− 5 37.7	348 15.0	70	+26 09.2	− 31
13	95 33.4	61 01.9	58.6	6 44.7	14.3	29 17.8	01.3	255 29.1	37.7	2 41.0	70	26 06.1	− 33
14	110 35.9	76 02.2	59.2	21 45.3	14.3	44 19.6	01.4	270 31.6	37.7	17 07.0	71	26 02.8	− 34
15	125 38.4	91 02.5	•10 59.8	36 46.0	•• 14.4	59 21.5	•• 01.5	285 34.1	•• 37.7	31 33.1	72	•25 59.4	− 35
16	140 40.8	106 02.8	11 00.4	51 46.6	14.4	74 23.3	01.6	300 36.6	37.7	45 59.3	73	25 55.9	− 37
17	155 43.3	121 03.2	01.0	66 47.2	14.4	89 25.2	01.7	315 39.1	37.7	60 25.6	73	25 52.2	− 39
18	170 45.8	136 03.5	+11 01.6	81 47.8	+24 14.4	104 27.0	+21 01.8	330 41.6	− 5 37.7	74 51.9	74	+25 48.3	− 40
19	185 48.2	151 03.8	02.2	96 48.5	14.5	119 28.9	01.9	345 44.1	37.7	89 18.3	75	25 44.3	− 41
20	200 50.7	166 04.1	02.8	111 49.1	14.5	134 30.7	02.0	0 46.6	37.7	103 44.8	76	25 40.2	− 43
21	215 53.1	181 04.5	•• 03.4	126 49.7	•• 14.5	149 32.6	•• 02.1	15 49.2	•• 37.6	118 11.4	76	•25 35.9	− 44
22	230 55.6	196 04.8	04.1	141 50.4	14.6	164 34.4	02.2	30 51.7	37.6	132 38.0	78	25 31.5	− 46
23	245 58.1	211 05.1	04.7	156 51.0	14.6	179 36.3	02.3	45 54.2	37.6	147 04.8	78	25 26.9	− 46
13 0	261 00.5	226 05.4	+11 05.3	171 51.6	+24 14.6	194 38.2	+21 02.4	60 56.7	− 5 37.6	161 31.6	78	+25 22.3	− 49
1	276 03.0	241 05.7	05.9	186 52.2	14.6	209 40.0	02.5	75 59.2	37.6	175 58.4	80	25 17.4	− 50
2	291 05.5	256 06.0	06.5	201 52.9	14.7	224 41.9	02.6	91 01.7	37.6	190 25.4	81	25 12.4	− 51
3	306 07.9	271 06.3	•• 07.1	216 53.5	•• 14.7	239 43.7	•• 02.7	106 04.2	•• 37.6	204 52.5	81	•25 07.3	− 52
4	321 10.4	286 06.7	07.7	231 54.1	14.7	254 45.6	02.8	121 06.7	37.6	219 19.6	82	25 02.1	− 54
5	336 12.9	301 07.0	08.3	246 54.8	14.7	269 47.4	02.9	136 09.2	37.6	233 46.8	83	24 56.7	− 55
6	351 15.3	316 07.3	+11 08.9	261 55.4	+24 14.8	284 49.3	+21 03.0	151 11.7	− 5 37.6	248 14.1	84	+24 51.2	− 56
7	6 17.8	331 07.6	09.6	276 56.0	14.8	299 51.1	03.1	166 14.2	37.6	262 41.5	85	24 45.6	− 58
8	21 20.3	346 07.9	10.2	291 56.6	14.8	314 53.0	03.1	181 16.8	37.6	277 09.0	86	24 39.8	− 59
9	36 22.7	1 08.2	•• 10.8	306 57.3	•• 14.8	329 54.8	•• 03.2	196 19.3	•• 37.6	291 36.6	86	•24 33.9	− 61
10	51 25.2	16 08.5	11.4	321 57.9	14.9	344 56.7	03.3	211 21.8	37.6	306 04.2	88	24 27.8	− 61
11	66 27.6	31 08.8	12.0	336 58.5	14.9	359 58.5	03.4	226 24.3	37.6	320 32.0	88	24 21.7	− 63
12	81 30.1	46 09.1	+11 12.6	351 59.2	+24 14.9	15 00.4	+21 03.5	241 26.8	− 5 37.5	334 59.8	90	+24 15.4	− 64
13	96 32.6	61 09.4	13.2	6 59.8	14.9	30 02.3	03.6	256 29.3	37.5	349 27.8	90	24 09.0	− 65
14	111 35.0	76 09.7	13.9	22 00.4	14.9	45 04.1	03.7	271 31.8	37.5	3 55.8	91	24 02.5	− 67
15	126 37.5	91 10.0	•• 14.5	37 01.0	•• 15.0	60 06.0	•• 03.8	286 34.3	•• 37.5	18 23.9	92	•23 55.8	− 68
16	141 40.0	106 10.3	15.1	52 01.7	15.0	75 07.8	03.9	301 36.8	37.5	32 52.1	93	23 49.0	− 68
17	156 42.4	121 10.6	15.7	67 02.3	15.0	90 09.7	04.0	316 39.3	37.5	47 20.4	94	23 42.2	− 71
18	171 44.9	136 10.9	+11 16.3	82 02.9	+24 15.0	105 11.5	+21 04.1	331 41.8	− 5 37.5	61 48.8	95	+23 35.1	− 71
19	186 47.4	151 11.2	16.9	97 03.6	15.1	120 13.4	04.2	346 44.3	37.5	76 17.3	96	23 28.0	− 72
20	201 49.8	166 11.5	17.5	112 04.2	15.1	135 15.2	04.3	1 46.8	37.5	90 45.9	97	23 20.8	− 74
21	216 52.3	181 11.8	•• 18.2	127 04.8	•• 15.1	150 17.1	•• 04.4	16 49.3	•• 37.5	105 14.6	98	•23 13.4	− 74
22	231 54.8	196 12.1	18.8	142 05.4	15.1	165 18.9	04.5	31 51.9	37.5	119 43.4	99	23 06.0	− 76
23	246 57.2	211 12.4	19.4	157 06.1	15.1	180 20.8	04.6	46 54.4	37.5	134 12.3	99	22 58.4	− 77
14 0	261 59.7	226 12.7	+11 20.0	172 06.7	+24 15.1	195 22.7	+21 04.6	61 56.9	− 5 37.5	148 41.2	101	+22 50.7	− 78
1	277 02.1	241 13.0	20.6	187 07.3	15.2	210 24.5	04.7	76 59.4	37.5	163 10.3	102	22 42.9	− 79
2	292 04.6	256 13.3	21.3	202 08.0	15.2	225 26.4	04.8	92 01.9	37.5	177 39.5	102	22 35.0	− 80
3	307 07.1	271 13.5	•• 21.9	217 08.6	•• 15.2	240 28.2	•• 04.9	107 04.4	•• 37.5	192 08.7	104	•22 27.0	− 82
4	322 09.5	286 13.8	22.5	232 09.2	15.2	255 30.1	05.0	122 06.9	37.5	206 38.1	104	22 18.8	− 82
5	337 12.0	301 14.1	23.1	247 09.8	15.2	270 31.9	05.1	137 09.4	37.5	221 07.5	106	22 10.6	− 83
6	352 14.5	316 14.4	+11 23.7	262 10.5	+24 15.2	285 33.8	+21 05.2	152 11.9	− 5 37.4	235 37.1	106	+22 02.3	− 84
7	7 16.9	331 14.7	24.4	277 11.1	15.3	300 35.6	05.3	167 14.4	37.4	250 06.7	108	21 53.9	− 86
8	22 19.4	346 15.0	25.0	292 11.7	15.3	315 37.5	05.4	182 16.9	37.4	264 36.5	108	21 45.3	− 86
9	37 21.9	1 15.3	•• 25.6	307 12.4	•• 15.3	330 39.4	•• 05.5	197 19.4	•• 37.4	279 06.3	109	•21 36.7	− 87
10	52 24.3	16 15.5	26.2	322 13.0	15.3	345 41.2	05.6	212 21.9	37.4	293 36.2	111	21 28.0	− 88
11	67 26.8	31 15.8	26.8	337 13.6	15.3	0 43.1	05.7	227 24.4	37.4	308 06.3	111	21 19.2	− 90
12	82 29.3	46 16.1	+11 27.5	352 14.3	+24 15.3	15 44.9	+21 05.8	242 26.9	− 5 37.4	322 36.4	112	+21 10.2	− 90
13	97 31.7	61 16.4	28.1	7 14.9	15.3	30 46.8	05.9	257 29.4	37.4	337 06.6	113	21 01.2	− 91
14	112 34.2	76 16.7	28.7	22 15.5	15.4	45 48.6	05.9	272 31.9	37.4	351 36.9	115	20 52.1	− 92
15	127 36.6	91 16.9	•• 29.3	37 16.1	•• 15.4	60 50.5	•• 06.0	287 34.4	•• 37.4	6 07.4	115	•20 42.9	− 93
16	142 39.1	106 17.2	29.9	52 16.8	15.4	75 52.3	06.1	302 36.9	37.4	20 37.9	116	20 33.6	− 93
17	157 41.6	121 17.5	30.6	67 17.4	15.4	90 54.2	06.2	317 39.4	37.4	35 08.5	117	20 24.3	− 95
18	172 44.0	136 17.8	+11 31.2	82 18.0	+24 15.4	105 56.1	+21 06.3	332 41.9	− 5 37.4	49 39.2	118	+20 14.8	− 95
19	187 46.5	151 18.0	31.8	97 18.7	15.4	120 57.9	06.4	347 44.4	37.4	64 10.0	119	20 05.3	− 97
20	202 49.0	166 18.3	32.4	112 19.3	15.4	135 59.8	06.5	2 46.9	37.4	78 40.9	119	19 55.6	− 97
21	217 51.4	181 18.6	•• 33.1	127 19.9	•• 15.4	151 01.6	•• 06.6	17 49.4	•• 37.4	93 11.8	121	•19 45.9	− 98
22	232 53.9	196 18.8	33.7	142 20.6	15.4	166 03.5	06.7	32 51.9	37.4	107 42.9	122	19 36.1	− 99
23	247 56.4	211 19.1	34.3	157 21.2	15.5	181 05.3	06.8	47 54.4	37.4	122 14.1	122	19 26.2	− 99
24	262 58.8	226 19.4	+11 34.9	172 21.8	+24 15.5	196 07.2	+21 06.9	62 57.0	− 5 37.4	136 45.3	124	+19 16.3	−101
code	−	+ 3	+ 6	+ 6	0	+ 19	+ 1	+ 25	0				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
12	0	180 06.7	+23 07.3
	1	195 06.6	07.5
	2	210 06.4	07.7
	3	225 06.3	07.8
	4	240 06.2	08.0
	5	255 06.1	08.2
	6	270 05.9	+23 08.3
	7	285 05.8	08.5
	8	300 05.7	08.7
	9	315 05.5	08.8
	10	330 05.4	09.0
	11	345 05.3	09.1
	12	0 05.2	+23 09.3
	13	15 05.0	09.4
	14	30 04.9	09.6
	15	45 04.8	09.8
	16	60 04.6	09.9
	17	75 04.5	10.1
	18	90 04.4	+23 10.2
	19	105 04.2	10.4
	20	120 04.1	10.5
	21	135 04.0	10.7
	22	150 03.9	10.8
	23	165 03.7	11.0
13	0	180 03.6	+23 11.1
	1	195 03.5	11.3
	2	210 03.3	11.4
	3	225 03.2	11.6
	4	240 03.1	11.7
	5	255 02.9	11.9
	6	270 02.8	+23 12.0
	7	285 02.7	12.2
	8	300 02.6	12.3
	9	315 02.4	12.5
	10	330 02.3	12.6
	11	345 02.2	12.7
	12	0 02.0	+23 12.9
	13	15 01.9	13.0
	14	30 01.8	13.2
	15	45 01.6	13.3
	16	60 01.5	13.4
	17	75 01.4	13.6
	18	90 01.2	+23 13.7
	19	105 01.1	13.8
	20	120 01.0	14.0
	21	135 00.8	14.1
	22	150 00.7	14.3
	23	165 00.6	14.4
14	0	180 00.5	+23 14.5
	1	195 00.3	14.7
	2	210 00.2	14.8
	3	225 00.1	14.9
	4	239 59.9	15.0
	5	254 59.8	15.2
	6	269 59.7	+23 15.3
	7	284 59.5	15.4
	8	299 59.4	15.6
	9	314 59.3	15.7
	10	329 59.1	15.8
	11	344 59.0	15.9
	12	359 58.9	+23 16.1
	13	14 58.7	16.2
	14	29 58.6	16.3
	15	44 58.5	16.4
	16	59 58.3	16.5
	17	74 58.2	16.7
	18	89 58.1	+23 16.8
	19	104 57.9	16.9
	20	119 57.8	17.0
	21	134 57.7	17.1
	22	149 57.5	17.3
	23	164 57.4	17.4
	24	179 57.3	+23 17.5
	code	−	+ 1

No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.7	−40 29.2
5	Achernar	336 00.3	−57 28.0
30	Acrux	173 59.8	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.7	+56 12.9
34	Alkaid	153 33.9	+49 32.8
55	Al Na'ir	28 39.9	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.7	+26 52.2
1	Alpheratz	358 30.3	+28 49.9
51	Altair	62 51.9	+ 8 44.6
2	Ankaa	354 00.0	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.1	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.2
12	Capella	281 41.5	+45 57.2
53	Deneb	50 01.9	+45 06.6
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.1	−18 14.3
27	Dubhe	194 46.6	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.5
54	Enif	34 31.2	+ 9 39.6
56	Fomalhaut	16 13.4	−29 52.0
31	Gacrux	172 51.2	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.6	−60 09.3
6	Hamal	328 51.9	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.6	+74 20.8
57	Markab	14 23.2	+14 57.2
8	Menkar	315 02.4	+ 3 54.6
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.2	−69 31.8
9	Mirfak	309 45.4	+49 41.8
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.5	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.4
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.7	− 8 15.2
38	Rigil Kent.	140 53.0	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.3	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.2
39	Zub'g'bi	137 55.1	−15 51.2

GMT h	Equation of Time (App.—Mean) 12 m s	13 m s	14 m s
0	+ 0 27.1	+ 0 14.7	+ 0 02.1
6	+ 0 24.0	+ 0 11.5	− 0 01.1
12	+ 0 20.9	+ 0 08.4	− 0 04.3
18	+ 0 17.8	+ 0 05.2	− 0 07.5
24	+ 0 14.7	+ 0 02.1	− 0 10.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 12 h m	13 h m	14 h m	15 h m
72	□	□	□	□	□	□
70	□	□	□	□	□	4 38
68	□	□	□	□	□	5 25
66	□	□	□	□	3 46	5 55
64	1 35	////	□	2 25	4 28	6 17
62	2 11	////	1 48	3 16	4 57	6 34
60	2 37	////	2 28	3 48	5 18	6 49
58	2 57	////	2 56	4 11	5 36	7 01
56	3 14	////	3 18	4 30	5 51	7 12
54	3 28	////	3 36	4 46	6 03	7 21
52	3 40	////	3 51	5 00	6 14	7 30
50	3 50	////	4 04	5 12	6 24	7 37
45	4 13	1 42	4 32	5 36	6 45	7 53
40	4 30	2 28	4 53	5 56	7 02	8 06
35	4 45	2 58	5 11	6 13	7 15	8 17
30	4 58	3 22	5 26	6 27	7 28	8 27
20	5 20	3 56	5 52	6 51	7 48	8 43
10	5 39	4 22	6 14	7 12	8 06	8 57
0	5 56	4 41	6 35	7 31	8 23	9 11
10	6 13	4 58	6 56	7 50	8 39	9 24
20	6 32	5 13	7 19	8 11	8 57	9 38
30	6 53	5 27	7 45	8 35	9 17	9 54
35	7 05	5 34	8 00	8 49	9 29	10 04
40	7 19	5 42	8 18	9 05	9 43	10 14
45	7 36	5 48	8 39	9 24	9 59	10 27
50	7 56	5 57	9 06	9 48	10 19	10 42
52	8 06	5 59	9 19	9 59	10 28	10 49
54	8 17	6 03	9 34	10 12	10 38	10 56
56	8 30	6 07	9 52	10 27	10 50	11 05
58	8 44	6 11	10 13	10 45	11 03	11 15
60	9 01	6 15	10 40	11 06	11 19	11 26
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 12 h m	13 h m	14 h m	15 h m
72	□	□	□	□	□	□
70	□	□	□	□	□	1 37
68	□	□	□	□	□	0 49
66	□	□	□	□	0 45	0 18
64	22 26	////	□	0 15	{0 23 / 02 55}	23 49
62	21 49	////	23 24	23 33	23 36	23 37
60	21 23	////	22 52	23 11	23 21	23 26
58	21 03	////	22 28	22 53	23 08	23 17
56	20 47	////	22 09	22 37	22 56	23 09
54	20 33	////	21 52	22 24	22 46	23 02
52	20 21	////	21 38	22 13	22 37	22 56
50	20 10	////	21 26	22 02	22 29	22 50
45	19 47	22 19	21 01	21 41	22 12	22 37
40	19 30	21 33	20 41	21 23	21 58	22 27
35	19 15	21 02	20 24	21 09	21 46	22 18
30	19 02	20 38	20 09	20 56	21 36	22 10
20	18 40	20 04	19 44	20 34	21 17	21 56
10	18 21	19 39	19 23	20 14	21 01	21 44
0	18 04	19 19	19 02	19 56	20 46	21 32
10	17 46	19 01	18 42	19 38	20 31	21 21
20	17 28	18 47	18 20	19 19	20 15	21 09
30	17 07	18 32	17 55	18 56	19 56	20 54
35	16 55	18 26	17 40	18 43	19 45	20 46
40	16 41	18 18	17 23	18 27	19 33	20 37
45	16 24	18 11	17 01	18 09	19 18	20 25
50	16 04	18 03	16 35	17 46	18 59	20 12
52	15 54	18 00	16 22	17 35	18 50	20 05
54	15 43	17 56	16 07	17 22	18 40	19 58
56	15 30	17 52	15 50	17 07	18 29	19 50
58	15 16	17 48	15 29	16 50	18 17	19 41
60	14 59	17 44	15 01	16 29	18 01	19 31
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
12	12 49	8 56	12 33	11 03	19 57
13	13 44	8 56	12 32	11 00	19 53
14	14 35	8 55	12 31	10 57	19 49
15	15 22	8 55	12 30	10 54	19 45

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	12 ′	13 ′	14 ′
0	15.4	14.7	13.9
4	15.4	14.7	13.9
8	15.4	14.7	13.9
12	15.4	14.7	13.9
16	15.4	14.7	14.0
20	15.4	14.7	14.0
24	15.4	14.7	14.0
28	15.4	14.8	14.1
32	15.4	14.8	14.1
36	15.4	14.8	14.2
40	15.4	14.8	14.2
44	15.5	14.9	14.3
48	15.5	14.9	14.4
52	15.5	14.9	14.4
56	15.5	15.0	14.5
60	15.5	15.0	14.6
64	15.5	15.1	14.7
68	15.5	15.1	14.8
72	15.5	15.2	14.8
76	15.5	15.2	14.9
80	15.5	15.3	15.0
84	15.5	15.3	15.1
88	15.5	15.3	15.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	12 ′	13 ′	14 ′
0	15.6	16.1	16.5
4	15.6	16.1	16.5
8	15.6	16.0	16.5
12	15.6	16.0	16.5
16	15.6	16.0	16.4
20	15.6	16.0	16.4
24	15.6	16.0	16.4
28	15.6	16.0	16.3
32	15.6	15.9	16.3
36	15.6	15.9	16.2
40	15.6	15.9	16.2
44	15.6	15.8	16.1
48	15.6	15.8	16.0
52	15.6	15.8	16.0
56	15.6	15.7	15.9
60	15.6	15.7	15.8
64	15.6	15.6	15.7
68	15.6	15.6	15.6
72	15.6	15.6	15.6
76	15.5	15.5	15.5
80	15.5	15.5	15.4
84	15.5	15.4	15.3
88	15.5	15.4	15.2
90			

Subtract from table, back cover

918768°—52——8

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
15 h 0	262 58.8	226 19.4	+11 34.9	172 21.8	+24 15.5	196 07.2	+21 06.9	62 57.0	− 5 37.4	136 45.3	124	+19 16.3	−101
1	278 01.3	241 19.6	35.6	187 22.4	15.5	211 09.0	07.0	77 59.5	37.4	151 16.7	124	19 06.2	−101
2	293 03.7	256 19.9	36.2	202 23.1	15.5	226 10.9	07.1	93 02.0	37.4	165 48.1	125	18 56.1	−102
3	308 06.2	271 20.2	•• 36.8	217 23.7	•• 15.5	241 12.7	•• 07.2	108 04.5	•• 37.4	180 19.6	127	•18 45.9	−103
4	323 08.7	286 20.4	37.4	232 24.3	15.5	256 14.6	07.2	123 07.0	37.4	194 51.3	127	18 35.6	−103
5	338 11.1	301 20.7	38.1	247 25.0	15.5	271 16.5	07.3	138 09.5	37.3	209 23.0	128	18 25.3	−104
6	353 13.6	316 21.0	+11 38.7	262 25.6	+24 15.5	286 18.3	+21 07.4	153 12.0	− 5 37.3	223 54.8	129	+18 14.9	−105
7	8 16.1	331 21.2	39.3	277 26.2	15.5	301 20.2	07.5	168 14.5	37.3	238 26.7	129	18 04.4	−106
8	23 18.5	346 21.5	39.9	292 26.9	15.5	316 22.0	07.6	183 17.0	37.3	252 58.6	131	17 53.8	−106
9	38 21.0	1 21.8	•• 40.6	307 27.5	•• 15.5	331 23.9	•• 07.7	198 19.5	•• 37.3	267 30.7	131	•17 43.2	−107
10	53 23.5	16 22.0	41.2	322 28.1	15.5	346 25.7	07.8	213 22.0	37.3	282 02.8	133	17 32.5	−108
11	68 25.9	31 22.3	41.8	337 28.8	15.5	1 27.6	07.9	228 24.5	37.3	296 35.1	133	17 21.7	−108
12	83 28.4	46 22.5	+11 42.4	352 29.4	+24 15.6	16 29.5	+21 08.0	243 27.0	− 5 37.3	311 07.4	134	+17 10.9	−109
13	98 30.9	61 22.8	43.1	7 30.0	15.6	31 31.3	08.1	258 29.5	37.3	325 39.8	135	17 00.0	−110
14	113 33.3	76 23.0	43.7	22 30.6	15.6	46 33.2	08.2	273 32.0	37.3	340 12.3	135	16 49.0	−110
15	128 35.8	91 23.3	•• 44.3	37 31.3	•• 15.6	61 35.0	•• 08.3	288 34.5	•• 37.3	354 44.8	137	•16 38.0	−111
16	143 38.2	106 23.5	45.0	52 31.9	15.6	76 36.9	08.3	303 37.0	37.3	9 17.5	137	16 26.9	−112
17	158 40.7	121 23.8	45.6	67 32.5	15.6	91 38.7	08.4	318 39.5	37.3	23 50.2	138	16 15.7	−112
18	173 43.2	136 24.0	+11 46.2	82 33.2	+24 15.6	106 40.6	+21 08.5	333 42.0	− 5 37.3	38 23.0	139	+16 04.5	−112
19	188 45.6	151 24.3	46.8	97 33.8	15.6	121 42.4	08.6	348 44.5	37.3	52 55.9	140	15 53.3	−114
20	203 48.1	166 24.5	47.5	112 34.4	15.6	136 44.3	08.7	3 47.0	37.3	67 28.9	140	15 41.9	−114
21	218 50.6	181 24.8	•• 48.1	127 35.1	•• 15.6	151 46.2	•• 08.8	18 49.5	•• 37.3	82 01.9	141	•15 30.5	−114
22	233 53.0	196 25.0	48.7	142 35.7	15.6	166 48.0	08.9	33 52.0	37.3	96 35.0	142	15 19.1	−115
23	248 55.5	211 25.3	49.4	157 36.3	15.6	181 49.9	09.0	48 54.4	37.3	111 08.2	143	15 07.6	−116
16 0	263 58.0	226 25.5	+11 50.0	172 37.0	+24 15.6	196 51.7	+21 09.1	63 56.9	− 5 37.3	125 41.5	144	+14 56.0	−116
1	279 00.4	241 25.8	50.6	187 37.6	15.6	211 53.6	09.2	78 59.4	37.3	140 14.9	144	14 44.4	−116
2	294 02.9	256 26.0	51.3	202 38.2	15.6	226 55.4	09.3	94 01.9	37.3	154 48.3	145	14 32.8	−117
3	309 05.4	271 26.3	•• 51.9	217 38.9	•• 15.6	241 57.3	•• 09.4	109 04.4	•• 37.3	169 21.8	145	•14 21.1	−118
4	324 07.8	286 26.5	52.5	232 39.5	15.6	256 59.2	09.4	124 06.9	37.3	183 55.3	147	14 09.3	−118
5	339 10.3	301 26.7	53.1	247 40.1	15.6	272 01.0	09.5	139 09.4	37.3	198 29.0	147	13 57.5	−119
6	354 12.7	316 27.0	+11 53.8	262 40.8	+24 15.6	287 02.9	+21 09.6	154 11.9	− 5 37.3	213 02.7	147	+13 45.6	−119
7	9 15.2	331 27.2	54.4	277 41.4	15.6	302 04.7	09.7	169 14.4	37.3	227 36.4	149	13 33.7	−119
8	24 17.7	346 27.5	55.0	292 42.0	15.6	317 06.6	09.8	184 16.9	37.3	242 10.3	149	13 21.8	−120
9	39 20.1	1 27.7	•• 55.7	307 42.7	•• 15.6	332 08.4	•• 09.9	199 19.4	•• 37.3	256 44.2	150	•13 09.8	−121
10	54 22.6	16 27.9	56.3	322 43.3	15.6	347 10.3	10.0	214 21.9	37.3	271 18.2	150	12 57.7	−120
11	69 25.1	31 28.2	56.9	337 43.9	15.6	2 12.2	10.1	229 24.4	37.3	285 52.2	151	12 45.7	−122
12	84 27.5	46 28.4	+11 57.6	352 44.6	+24 15.6	17 14.0	+21 10.2	244 26.9	− 5 37.3	300 26.3	152	+12 33.5	−121
13	99 30.0	61 28.6	58.2	7 45.2	15.6	32 15.9	10.3	259 29.4	37.3	315 00.5	152	12 21.4	−122
14	114 32.5	76 28.9	58.8	22 45.8	15.6	47 17.7	10.4	274 31.9	37.3	329 34.7	153	12 09.2	−123
15	129 34.9	91 29.1	•11 59.5	37 46.5	•• 15.6	62 19.6	•• 10.4	289 34.4	•• 37.3	344 09.0	154	•11 56.9	−123
16	144 37.4	106 29.3	12 00.1	52 47.1	15.5	77 21.4	10.5	304 36.9	37.3	358 43.4	154	11 44.6	−123
17	159 39.9	121 29.6	00.7	67 47.7	15.5	92 23.3	10.6	319 39.4	37.3	13 17.8	154	11 32.3	−124
18	174 42.3	136 29.8	+12 01.4	82 48.4	+24 15.5	107 25.2	+21 10.7	334 41.9	− 5 37.3	27 52.2	155	+11 19.9	−124
19	189 44.8	151 30.0	02.0	97 49.0	15.5	122 27.0	10.8	349 44.4	37.3	42 26.7	156	11 07.5	−124
20	204 47.2	166 30.2	.02.6	112 49.6	15.5	137 28.9	10.9	4 46.9	37.3	57 01.3	157	10 55.1	−125
21	219 49.7	181 30.5	•• 03.3	127 50.3	•• 15.5	152 30.7	•• 11.0	19 49.4	•• 37.3	71 36.0	156	•10 42.6	−125
22	234 52.2	196 30.7	03.9	142 50.9	15.5	167 32.6	11.1	34 51.9	37.3	86 10.6	158	10 30.1	−125
23	249 54.6	211 30.9	04.5	157 51.5	15.5	182 34.4	11.2	49 54.4	37.3	100 45.4	158	10 17.6	−126
17 0	264 57.1	226 31.1	+12 05.2	172 52.2	+24 15.5	197 36.3	+21 11.3	64 56.9	− 5 37.3	115 20.2	158	+10 05.0	−126
1	279 59.6	241 31.4	05.8	187 52.8	15.5	212 38.2	11.3	79 59.3	37.3	129 55.0	159	9 52.4	−126
2	295 02.0	256 31.6	06.5	202 53.4	15.5	227 40.0	11.4	95 01.8	37.3	144 29.9	160	9 39.8	−127
3	310 04.5	271 31.8	•• 07.1	217 54.1	•• 15.5	242 41.9	•• 11.5	110 04.3	•• 37.3	159 04.9	160	• 9 27.1	−127
4	325 07.0	286 32.0	07.7	232 54.7	15.5	257 43.7	11.6	125 06.8	37.3	173 39.9	160	9 14.4	−127
5	340 09.4	301 32.2	08.4	247 55.3	15.4	272 45.6	11.7	140 09.3	37.3	188 14.9	161	9 01.7	−128
6	355 11.9	316 32.4	+12 09.0	262 56.0	+24 15.4	287 47.4	+21 11.8	155 11.8	− 5 37.3	202 50.0	161	+ 8 48.9	−127
7	10 14.3	331 32.7	09.6	277 56.6	15.4	302 49.3	11.9	170 14.3	37.3	217 25.1	162	8 36.2	−128
8	25 16.8	346 32.9	10.3	292 57.2	15.4	317 51.2	12.0	185 16.8	37.3	232 00.3	162	8 23.4	−129
9	40 19.3	1 33.1	•• 10.9	307 57.9	•• 15.4	332 53.0	•• 12.1	200 19.3	•• 37.3	246 35.5	162	• 8 10.5	−128
10	55 21.7	16 33.3	11.5	322 58.5	15.4	347 54.9	12.2	215 21.8	37.3	261 10.7	163	7 57.7	−129
11	70 24.2	31 33.5	12.2	337 59.1	15.4	2 56.7	12.2	230 24.3	37.3	275 46.0	164	7 44.8	−129
12	85 26.7	46 33.7	+12 12.8	352 59.8	+24 15.4	17 58.6	+21 12.3	245 26.8	− 5 37.3	290 21.4	163	+ 7 31.9	−129
13	100 29.1	61 33.9	13.5	8 00.4	15.4	33 00.4	12.4	260 29.3	37.3	304 56.7	164	7 19.0	−130
14	115 31.6	76 34.2	14.1	23 01.0	15.3	48 02.3	12.5	275 31.8	37.3	319 32.1	165	7 06.0	−129
15	130 34.1	91 34.4	•• 14.7	38 01.7	•• 15.3	63 04.2	•• 12.6	290 34.2	•• 37.3	334 07.6	165	• 6 53.1	−130
16	145 36.5	106 34.6	15.4	53 02.3	15.3	78 06.0	12.7	305 36.7	37.3	348 43.1	165	6 40.1	−130
17	160 39.0	121 34.8	16.0	68 03.0	15.3	93 07.9	12.8	320 39.2	37.3	3 18.6	165	6 27.1	−131
18	175 41.5	136 35.0	+12 16.6	83 03.6	+24 15.3	108 09.7	+21 12.9	335 41.7	− 5 37.3	17 54.1	166	+ 6 14.0	−130
19	190 43.9	151 35.2	17.3	98 04.2	15.3	123 11.6	13.0	350 44.2	37.3	32 29.7	166	6 01.0	−131
20	205 46.4	166 35.4	17.9	113 04.9	15.3	138 13.5	13.0	5 46.7	37.3	47 05.3	166	5 47.9	−131
21	220 48.8	181 35.6	•• 18.6	128 05.5	•• 15.2	153 15.3	•• 13.1	20 49.2	•• 37.3	61 40.9	167	• 5 34.8	−130
22	235 51.3	196 35.8	19.2	143 06.1	15.2	168 17.2	13.2	35 51.7	37.3	76 16.6	167	5 21.8	−132
23	250 53.8	211 36.0	19.8	158 06.8	15.2	183 19.0	13.3	50 54.2	37.3	90 52.3	167	5 08.6	−131
24	265 56.2	226 36.2	+12 20.5	173 07.4	+24 15.2	198 20.9	+21 13.4	65 56.7	− 5 37.3	105 28.0	168	+ 4 55.5	−131
code	−	+ 2	+ 6	+ 6	0	+ 19	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.
15 h 0	179 57.3	+23 17.5
1	194 57.1	17.6
2	209 57.0	17.7
3	224 56.9	17.8
4	239 56.7	17.9
5	254 56.6	18.1
6	269 56.5	+23 18.2
7	284 56.3	18.3
8	299 56.2	18.4
9	314 56.1	18.5
10	329 55.9	18.6
11	344 55.8	18.7
12	359 55.7	+23 18.8
13	14 55.5	18.9
14	29 55.4	19.0
15	44 55.3	19.1
16	59 55.1	19.2
17	74 55.0	19.3
18	89 54.9	+23 19.5
19	104 54.7	19.6
20	119 54.6	19.7
21	134 54.5	19.8
22	149 54.3	19.9
23	164 54.2	20.0
16 h 0	179 54.1	+23 20.1
1	194 53.9	20.2
2	209 53.8	20.3
3	224 53.7	20.3
4	239 53.5	20.4
5	254 53.4	20.5
6	269 53.3	+23 20.6
7	284 53.1	20.7
8	299 53.0	20.8
9	314 52.9	20.9
10	329 52.7	21.0
11	344 52.6	21.1
12	359 52.4	+23 21.2
13	14 52.3	21.3
14	29 52.2	21.4
15	44 52.0	21.4
16	59 51.9	21.5
17	74 51.8	21.6
18	89 51.6	+23 21.7
19	104 51.5	21.8
20	119 51.4	21.9
21	134 51.2	22.0
22	149 51.1	22.0
23	164 51.0	22.1
17 h 0	179 50.8	+23 22.2
1	194 50.7	22.3
2	209 50.6	22.4
3	224 50.4	22.4
4	239 50.3	22.5
5	254 50.2	22.6
6	269 50.0	+23 22.7
7	284 49.9	22.8
8	299 49.7	22.8
9	314 49.6	22.9
10	329 49.5	23.0
11	344 49.3	23.1
12	359 49.2	+23 23.1
13	14 49.1	23.2
14	29 48.9	23.3
15	44 48.8	23.3
16	59 48.7	23.4
17	74 48.5	23.5
18	89 48.4	+23 23.5
19	104 48.3	23.6
20	119 48.1	23.7
21	134 48.0	23.7
22	149 47.8	23.8
23	164 47.7	23.9
24	179 47.6	+23 23.9
code	−	+ 1

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.7	−40 29.2
5	Achernar	336 00.3	−57 28.0
30	Acrux	173 59.8	−62 50.9
19	Adhara	255 48.3	−28 54.5
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.7	+56 12.9
34	Alkaid	153 33.9	+49 32.8
55	Al Na'ir	28 39.8	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.2	+28 49.9
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	354 00.0	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.1	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.5	+45 57.2
53	Deneb	50 01.9	+45 06.6
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.1	−18 14.3
27	Dubhe	194 46.7	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.5
54	Enif	34 31.1	+ 9 39.6
56	Fomalhaut	16 13.4	−29 51.9
31	Gacrux	172 51.2	−56 51.5
29	Gienah	176 38.6	−17 17.2
35	Hadar	149 51.7	−60 09.3
6	Hamal	328 51.9	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.6	+74 20.8
57	Markab	14 23.1	+14 57.2
8	Menkar	315 02.4	+ 3 54.6
36	Menkent	149 00.5	−36 08.8
24	Miapl'dus	221 50.2	−69 31.8
9	Mirfak	309 45.4	+49 41.8
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.5	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.7	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.3	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.2
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 15	16	17
h	m s	m s	m s
0	− 0 10.7	− 0 23.5	− 0 36.4
6	− 0 13.9	− 0 26.7	− 0 39.7
12	− 0 17.1	− 0 29.9	− 0 42.9
18	− 0 20.3	− 0 33.2	− 0 46.2
24	− 0 23.5	− 0 36.4	− 0 49.4

Lat.	Sunrise	Twlt. begins	Moonrise 15	16	17	18
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	6 38	8 49	10 45
70	▭	▭	4 38	7 06	9 02	10 49
68	▭	▭	5 25	7 26	9 12	10 51
66	▭	▭	5 55	7 42	9 21	10 54
64	1 32	////	6 17	7 56	9 28	10 56
62	2 10	////	6 34	8 07	9 34	10 58
60	2 36	////	6 49	8 16	9 39	10 59
58	2 56	////	7 01	8 24	9 43	11 01
56	3 13	////	7 12	8 31	9 48	11 02
54	3 27	////	7 21	8 38	9 51	11 03
52	3 39	////	7 30	8 43	9 54	11 04
50	3 50	////	7 37	8 48	9 57	11 05
45	4 13	1 40	7 53	9 00	10 04	11 07
40	4 31	2 27	8 06	9 09	10 09	11 08
35	4 45	2 58	8 17	9 17	10 14	11 10
30	4 58	3 21	8 27	9 23	10 18	11 11
20	5 20	3 56	8 43	9 35	10 25	11 13
10	5 39	4 21	8 57	9 45	10 31	11 15
0	5 57	4 42	9 11	9 55	10 37	11 17
10	6 14	4 59	9 24	10 05	10 42	11 18
20	6 33	5 13	9 38	10 15	10 48	11 20
30	6 54	5 28	9 54	10 26	10 55	11 23
35	7 06	5 35	10 04	10 33	10 59	11 24
40	7 20	5 42	10 14	10 41	11 04	11 25
45	7 37	5 50	10 27	10 49	11 09	11 27
50	7 58	5 58	10 42	11 00	11 15	11 29
52	8 08	6 01	10 49	11 05	11 18	11 30
54	8 19	6 05	10 56	11 10	11 21	11 31
56	8 31	6 09	11 05	11 16	11 24	11 32
58	8 46	6 12	11 15	11 22	11 28	11 33
60	9 03	6 16	11 26	11 30	11 32	11 34
S						

Lat.	Sunset	Twlt. ends	Moonset 15	16	17	18
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	1 13	{0 29 / 23 58}	23 31
70	▭	▭	1 37	0 43	{0 14 / 23 52}	23 32
68	▭	▭	0 49	0 21	{0 02 / 23 47}	23 32
66	▭	▭	0 18	{0 03 / 23 52}	23 42	23 33
64	22 30	////	23 49	23 43	23 38	23 33
62	21 52	////	23 37	23 36	23 35	23 33
60	21 26	////	23 26	23 30	23 32	23 33
58	21 05	////	23 17	23 24	23 29	23 33
56	20 49	////	23 09	23 19	23 27	23 34
54	20 34	////	23 02	23 14	23 24	23 34
52	20 22	////	22 56	23 10	23 23	23 34
50	20 11	////	22 50	23 06	23 21	23 34
45	19 49	22 22	22 37	22 58	23 17	23 34
40	19 31	21 34	22 27	22 51	23 14	23 35
35	19 16	21 03	22 18	22 45	23 11	23 35
30	19 03	20 40	22 10	22 40	23 08	23 35
20	18 41	20 05	21 56	22 31	23 04	23 35
10	18 22	19 40	21 44	22 23	23 00	23 35
0	18 04	19 19	21 32	22 15	22 56	23 36
10	17 47	19 02	21 21	22 08	22 52	23 36
20	17 28	18 47	21 09	21 59	22 48	23 36
30	17 07	18 32	20 54	21 50	22 44	23 36
35	16 55	18 26	20 46	21 44	22 41	23 36
40	16 41	18 19	20 37	21 38	22 38	23 37
45	16 24	18 11	20 25	21 31	22 34	23 37
50	16 03	18 02	20 12	21 22	22 30	23 37
52	15 53	17 59	20 05	21 18	22 28	23 37
54	15 42	17 55	19 58	21 13	22 26	23 37
56	15 30	17 52	19 50	21 08	22 23	23 37
58	15 15	17 48	19 41	21 02	22 21	23 37
60	14 58	17 44	19 31	20 56	22 18	23 37
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
15	15 22	8 55	12 30	10 54	19 45
16	16 05	8 54	12 29	10 51	19 41
17	16 46	8 54	12 28	10 48	19 37
18	17 26	8 54	12 27	10 45	19 33

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	15	16	17
°	′	′	′
0	13.3	12.6	12.2
4	13.3	12.6	12.3
8	13.3	12.7	12.3
12	13.3	12.7	12.3
16	13.3	12.7	12.4
20	13.4	12.8	12.4
24	13.4	12.9	12.5
28	13.5	12.9	12.6
32	13.6	13.0	12.7
36	13.6	13.1	12.8
40	13.7	13.2	12.9
44	13.8	13.3	13.0
48	13.9	13.4	13.2
52	14.0	13.6	13.3
56	14.1	13.7	13.5
60	14.2	13.8	13.6
64	14.3	14.0	13.8
68	14.4	14.1	14.0
72	14.6	14.3	14.1
76	14.7	14.4	14.3
80	14.8	14.6	14.5
84	14.9	14.8	14.7
88	15.0	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	15	16	17
°	′	′	′
0	16.9	17.2	17.4
4	16.8	17.2	17.4
8	16.8	17.2	17.4
12	16.8	17.2	17.4
16	16.8	17.1	17.3
20	16.7	17.1	17.3
24	16.7	17.0	17.2
28	16.6	16.9	17.1
32	16.6	16.8	17.0
36	16.5	16.7	16.9
40	16.4	16.6	16.8
44	16.3	16.5	16.6
48	16.2	16.4	16.5
52	16.1	16.3	16.4
56	16.0	16.1	16.2
60	15.9	16.0	16.1
64	15.8	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.2	15.2
84	15.2	15.1	15.0
88	15.1	15.0	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
18 0	265 56.2	226 36.2	+12 20.5	173 07.4	+24 15.2	198 20.9	+21 13.4	65 56.7	− 5 37.3	105 28.0	168	+ 4 55.5	−131
1	280 58.7	241 36.4	21.1	188 08.0	15.2	213 22.7	13.5	80 59.2	37.3	120 03.8	167	4 42.4	−132
2	296 01.2	256 36.6	21.8	203 08.7	15.2	228 24.6	13.6	96 01.6	37.3	134 39.5	168	4 29.2	−131
3	311 03.6	271 36.8	•• 22.4	218 09.3	•• 15.1	243 26.5	•• 13.7	111 04.1	•• 37.3	149 15.3	168	• 4 16.1	−132
4	326 06.1	286 37.0	23.0	233 09.9	15.1	258 28.3	13.8	126 06.6	37.3	163 51.1	169	4 02.9	−132
5	341 08.6	301 37.2	23.7	248 10.6	15.1	273 30.2	13.8	141 09.1	37.3	178 27.0	168	3 49.7	−132
6	356 11.0	316 37.4	+12 24.3	263 11.2	+24 15.1	288 32.0	+21 13.9	156 11.6	− 5 37.3	193 02.8	169	+ 3 36.5	−132
7	11 13.5	331 37.6	25.0	278 11.8	15.1	303 33.9	14.0	171 14.1	37.3	207 38.7	169	3 23.3	−133
8	26 16.0	346 37.8	25.6	293 12.5	15.0	318 35.8	14.1	186 16.6	37.3	222 14.6	169	3 10.0	−132
9	41 18.4	1 38.0	•• 26.2	308 13.1	•• 15.0	333 37.6	•• 14.2	201 19.1	•• 37.3	236 50.5	169	• 2 56.8	−132
10	56 20.9	16 38.2	26.9	323 13.8	15.0	348 39.5	14.3	216 21.6	37.3	251 26.4	169	2 43.6	−133
11	71 23.3	31 38.3	27.5	338 14.4	15.0	3 41.3	14.4	231 24.0	37.3	266 02.3	170	2 30.3	−132
12	86 25.8	46 38.5	+12 28.2	353 15.0	+24 15.0	18 43.2	+21 14.5	246 26.5	− 5 37.3	280 38.3	169	+ 2 17.1	−133
13	101 28.3	61 38.7	28.8	8 15.7	14.9	33 45.1	14.6	261 29.0	37.3	295 14.2	170	2 03.8	−132
14	116 30.7	76 38.9	29.4	23 16.3	14.9	48 46.9	14.6	276 31.5	37.3	309 50.2	170	1 50.6	−133
15	131 33.2	91 39.1	•• 30.1	38 16.9	•• 14.9	63 48.8	•• 14.7	291 34.0	•• 37.3	324 26.2	170	• 1 37.3	−133
16	146 35.7	106 39.3	30.7	53 17.6	14.9	78 50.6	14.8	306 36.5	37.3	339 02.2	169	1 24.0	−133
17	161 38.1	121 39.5	31.4	68 18.2	14.9	93 52.5	14.9	321 39.0	37.3	353 38.1	170	1 10.7	−133
18	176 40.6	136 39.6	+12 32.0	83 18.9	+24 14.8	108 54.3	+21 15.0	336 41.5	− 5 37.3	8 14.1	170	+ 0 57.4	−132
19	191 43.1	151 39.8	32.7	98 19.5	14.8	123 56.2	15.1	351 43.9	37.3	22 50.1	171	0 44.2	−133
20	206 45.5	166 40.0	33.3	113 20.1	14.8	138 58.1	15.2	6 46.4	37.3	37 26.2	170	0 30.9	−133
21	221 48.0	181 40.2	•• 33.9	128 20.8	•• 14.8	153 59.9	•• 15.3	21 48.9	•• 37.3	52 02.2	170	• 0 17.6	−133
22	236 50.4	196 40.4	34.6	143 21.4	14.7	169 01.8	15.3	36 51.4	37.3	66 38.2	170	+ 0 04.3	−133
23	251 52.9	211 40.6	35.2	158 22.0	14.7	184 03.6	15.4	51 53.9	37.3	81 14.2	170	− 0 09.0	−133
19 0	266 55.4	226 40.7	+12 35.9	173 22.7	+24 14.7	199 05.5	+21 15.5	66 56.4	− 5 37.3	95 50.2	170	− 0 22.3	−133
1	281 57.8	241 40.9	36.5	188 23.3	14.7	214 07.4	15.6	81 58.9	37.3	110 26.2	170	0 35.6	−133
2	297 00.3	256 41.1	37.2	203 24.0	14.6	229 09.2	15.7	97 01.4	37.3	125 02.2	170	0 48.9	−133
3	312 02.8	271 41.3	•• 37.8	218 24.6	•• 14.6	244 11.1	•• 15.8	112 03.8	•• 37.3	139 38.2	170	• 1 02.2	−132
4	327 05.2	286 41.4	38.4	233 25.2	14.6	259 12.9	15.9	127 06.3	37.3	154 14.2	170	1 15.4	−133
5	342 07.7	301 41.6	39.1	248 25.9	14.6	274 14.8	16.0	142 08.8	37.3	168 50.2	170	1 28.7	−133
6	357 10.2	316 41.8	+12 39.7	263 26.5	+24 14.5	289 16.7	+21 16.1	157 11.3	− 5 37.3	183 26.2	170	− 1 42.0	−133
7	12 12.6	331 42.0	40.4	278 27.1	14.5	304 18.5	16.1	172 13.8	37.3	198 02.2	169	1 55.3	−132
8	27 15.1	346 42.1	41.0	293 27.8	14.5	319 20.4	16.2	187 16.3	37.3	212 38.1	170	2 08.5	−133
9	42 17.6	1 42.3	•• 41.7	308 28.4	•• 14.4	334 22.2	•• 16.3	202 18.8	•• 37.3	227 14.1	169	• 2 21.8	−132
10	57 20.0	16 42.5	42.3	323 29.1	14.4	349 24.1	16.4	217 21.2	37.3	241 50.0	169	2 35.0	−133
11	72 22.5	31 42.6	43.0	338 29.7	14.4	4 26.0	16.5	232 23.7	37.3	256 25.9	170	2 48.3	−132
12	87 24.9	46 42.8	+12 43.6	353 30.3	+24 14.4	19 27.8	+21 16.6	247 26.2	− 5 37.3	271 01.9	169	− 3 01.5	−132
13	102 27.4	61 43.0	44.2	8 31.0	14.3	34 29.7	16.7	262 28.7	37.4	285 37.8	169	3 14.7	−133
14	117 29.9	76 43.1	44.9	23 31.6	14.3	49 31.5	16.8	277 31.2	37.4	300 13.7	168	3 28.0	−132
15	132 32.3	91 43.3	•• 45.5	38 32.2	•• 14.3	64 33.4	•• 16.8	292 33.7	•• 37.4	314 49.5	169	• 3 41.2	−132
16	147 34.8	106 43.5	46.2	53 32.9	14.2	79 35.3	16.9	307 36.1	37.4	329 25.4	168	3 54.4	−131
17	162 37.3	121 43.6	46.8	68 33.5	14.2	94 37.1	17.0	322 38.6	37.4	344 01.2	168	4 07.5	−132
18	177 39.7	136 43.8	+12 47.5	83 34.2	+24 14.2	109 39.0	+21 17.1	337 41.1	− 5 37.4	358 37.0	168	− 4 20.7	−132
19	192 42.2	151 44.0	48.1	98 34.8	14.1	124 40.8	17.2	352 43.6	37.4	13 12.8	167	4 33.9	−131
20	207 44.7	166 44.1	48.8	113 35.4	14.1	139 42.7	17.3	7 46.1	37.4	27 48.5	168	4 47.0	−132
21	222 47.1	181 44.3	•• 49.4	128 36.1	•• 14.1	154 44.6	•• 17.4	22 48.6	•• 37.4	42 24.3	167	• 5 00.2	−131
22	237 49.6	196 44.4	50.0	143 36.7	14.0	169 46.4	17.4	37 51.0	37.4	57 00.0	167	5 13.3	−131
23	252 52.1	211 44.6	50.7	158 37.4	14.0	184 48.3	17.5	52 53.5	37.4	71 35.7	166	5 26.4	−131
20 0	267 54.5	226 44.7	+12 51.3	173 38.0	+24 14.0	199 50.1	+21 17.6	67 56.0	− 5 37.4	86 11.3	167	− 5 39.5	−130
1	282 57.0	241 44.9	52.0	188 38.6	13.9	214 52.0	17.7	82 58.5	37.4	100 47.0	166	5 52.5	−131
2	297 59.4	256 45.1	52.6	203 39.3	13.9	229 53.9	17.8	98 01.0	37.4	115 22.6	166	6 05.6	−130
3	313 01.9	271 45.2	•• 53.3	218 39.9	•• 13.9	244 55.7	•• 17.9	113 03.5	•• 37.4	129 58.2	165	• 6 18.6	−131
4	328 04.4	286 45.4	53.9	233 40.6	13.8	259 57.6	18.0	128 05.9	37.4	144 33.7	165	6 31.7	−130
5	343 06.8	301 45.5	54.6	248 41.2	13.8	274 59.4	18.1	143 08.4	37.4	159 09.2	165	6 44.7	−129
6	358 09.3	316 45.7	+12 55.2	263 41.8	+24 13.8	290 01.3	+21 18.1	158 10.9	− 5 37.4	173 44.7	164	− 6 57.6	−130
7	13 11.8	331 45.8	55.9	278 42.5	13.7	305 03.2	18.2	173 13.4	37.4	188 20.1	164	7 10.6	−129
8	28 14.2	346 46.0	56.5	293 43.1	13.7	320 05.0	18.3	188 15.9	37.4	202 55.5	164	7 23.5	−130
9	43 16.7	1 46.1	•• 57.2	308 43.8	•• 13.7	335 06.9	•• 18.4	203 18.3	•• 37.4	217 30.9	163	• 7 36.5	−128
10	58 19.2	16 46.3	57.8	323 44.4	13.6	350 08.7	18.5	218 20.8	37.4	232 06.2	163	7 49.3	−129
11	73 21.6	31 46.4	58.4	338 45.0	13.6	5 10.6	18.6	233 23.3	37.4	246 41.5	162	8 02.2	−129
12	88 24.1	46 46.6	+12 59.1	353 45.7	+24 13.6	20 12.5	+21 18.7	248 25.8	− 5 37.4	261 16.7	162	− 8 15.1	−128
13	103 26.5	61 46.7	12 59.7	8 46.3	13.5	35 14.3	18.7	263 28.3	37.5	275 51.9	162	8 27.9	−128
14	118 29.0	76 46.9	13 00.4	23 47.0	13.5	50 16.2	18.8	278 30.8	37.5	290 27.1	161	8 40.7	−128
15	133 31.5	91 47.0	•• 01.0	38 47.6	•• 13.4	65 18.1	•• 18.9	293 33.2	•• 37.5	305 02.2	161	• 8 53.5	−127
16	148 33.9	106 47.1	01.7	53 48.2	13.4	80 19.9	19.0	308 35.7	37.5	319 37.3	160	9 06.2	−127
17	163 36.4	121 47.3	02.3	68 48.9	13.4	95 21.8	19.1	323 38.2	37.5	334 12.3	160	9 18.9	−127
18	178 38.9	136 47.4	+13 03.0	83 49.5	+24 13.3	110 23.6	+21 19.2	338 40.7	− 5 37.5	348 47.3	159	− 9 31.6	−127
19	193 41.3	151 47.6	03.6	98 50.2	13.3	125 25.5	19.3	353 43.1	37.5	3 22.2	159	9 44.3	−126
20	208 43.8	166 47.7	04.3	113 50.8	13.2	140 27.4	19.3	8 45.6	37.5	17 57.1	158	9 56.9	−126
21	223 46.3	181 47.8	•• 04.9	128 51.4	•• 13.2	155 29.2	•• 19.4	23 48.1	•• 37.5	32 31.9	158	• 10 09.5	−125
22	238 48.7	196 48.0	05.6	143 52.1	13.2	170 31.1	19.5	38 50.6	37.5	47 06.7	157	10 22.0	−126
23	253 51.2	211 48.1	06.2	158 52.7	13.1	185 32.9	19.6	53 53.1	37.5	61 41.4	156	10 34.6	−125
24	268 53.7	226 48.3	+13 06.9	173 53.4	+24 13.1	200 34.8	+21 19.7	68 55.5	− 5 37.5	76 16.0	157	−10 47.1	−124
code	−	+ 2	+ 6	+ 7	− 1	+ 19	+ 1	+ 25	− 1				

GMT	SUN GHA	SUN Dec.
	h ° ′	° ′
18 0	179 47.6	+23 23.9
1	194 47.4	24.0
2	209 47.3	24.1
3	224 47.2	24.1
4	239 47.0	24.2
5	254 46.9	24.3
6	269 46.8	+23 24.3
7	284 46.6	24.4
8	299 46.5	24.4
9	314 46.4	24.5
10	329 46.2	24.5
11	344 46.1	24.6
12	359 46.0	+23 24.7
13	14 45.8	24.7
14	29 45.7	24.8
15	44 45.5	24.8
16	59 45.4	24.9
17	74 45.3	24.9
18	89 45.1	+23 25.0
19	104 45.0	25.0
20	119 44.9	25.1
21	134 44.7	25.1
22	149 44.6	25.2
23	164 44.5	25.2
19 0	179 44.3	+23 25.3
1	194 44.2	25.3
2	209 44.0	25.4
3	224 43.9	25.4
4	239 43.8	25.5
5	254 43.6	25.5
6	269 43.5	+23 25.5
7	284 43.4	25.6
8	299 43.2	25.6
9	314 43.1	25.7
10	329 43.0	25.7
11	344 42.8	25.7
12	359 42.7	+23 25.8
13	14 42.6	25.8
14	29 42.4	25.9
15	44 42.3	25.9
16	59 42.1	25.9
17	74 42.0	26.0
18	89 41.9	+23 26.0
19	104 41.7	26.0
20	119 41.6	26.1
21	134 41.5	26.1
22	149 41.3	26.1
23	164 41.2	26.2
20 0	179 41.1	+23 26.2
1	194 40.9	26.2
2	209 40.8	26.2
3	224 40.7	26.3
4	239 40.5	26.3
5	254 40.4	26.3
6	269 40.2	+23 26.3
7	284 40.1	26.4
8	299 40.0	26.4
9	314 39.8	26.4
10	329 39.7	26.4
11	344 39.6	26.5
12	359 39.4	+23 26.5
13	14 39.3	26.5
14	29 39.2	26.5
15	44 39.0	26.5
16	59 38.9	26.6
17	74 38.7	26.6
18	89 38.6	+23 26.6
19	104 38.5	26.6
20	119 38.3	26.6
21	134 38.2	26.6
22	149 38.1	26.7
23	164 37.9	26.7
24	179 37.8	+23 26.7
code	—	0

No.	Name	STARS SHA	STARS Dec.
		° ′	° ′
7	Acamar	315 52.7	−40 29.1
5	Achernar	336 00.3	−57 28.0
30	Acrux	173 59.9	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.7	+56 12.9
34	Alkaid	153 33.9	+49 32.8
55	Al Na'ir	28 39.8	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.2	+28 49.9
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	354 00.0	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.1	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.4	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.5	+45 57.2
53	Deneb	50 01.9	+45 06.6
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.0	−18 14.3
27	Dubhe	194 46.7	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.5
54	Enif	34 31.1	+ 9 39.6
56	Fomalhaut	16 13.4	−29 51.9
31	Gacrux	172 51.2	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.7	−60 09.3
6	Hamal	328 51.8	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.7	+74 20.9
57	Markab	14 23.1	+14 57.3
8	Menkar	315 02.4	+ 3 54.6
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.3	−69 31.8
9	Mirfak	309 45.4	+49 41.8
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.4	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.2	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.3
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 18	19	20
h	m s	m s	m s
0	− 0 49.4	− 1 02.5	− 1 15.5
6	− 0 52.7	− 1 05.7	− 1 18.8
12	− 0 55.9	− 1 09.0	− 1 22.0
18	− 0 59.2	− 1 12.2	− 1 25.3
24	− 1 02.5	− 1 15.5	− 1 28.5

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 18 h m	19 h m	20 h m	21 h m
72	▭	▭	10 45	12 37	14 34	16 50
70	▭	▭	10 49	12 33	14 20	16 19
68	▭	▭	10 51	12 29	14 09	15 56
66	▭	▭	10 54	12 26	13 59	15 39
64	1 31	////	10 56	12 23	13 52	15 25
62	2 09	////	10 58	12 21	13 45	15 13
60	2 35	////	10 59	12 19	13 39	15 03
58	2 56	////	11 01	12 17	13 34	14 54
56	3 13	////	11 02	12 15	13 30	14 46
54	3 27	////	11 03	12 14	13 26	14 40
52	3 39	////	11 04	12 13	13 22	14 34
50	3 50	////	11 05	12 11	13 19	14 28
45	4 13	1 40	11 07	12 09	13 12	14 17
40	4 31	2 28	11 08	12 07	13 06	14 07
35	4 46	2 59	11 10	12 05	13 01	13 59
30	4 59	3 22	11 11	12 04	12 57	13 51
20	5 21	3 57	11 13	12 01	12 49	13 39
10	5 40	4 22	11 15	11 58	12 42	13 28
0	5 58	4 42	11 17	11 56	12 36	13 18
10	6 15	5 00	11 18	11 54	12 30	13 08
20	6 33	5 14	11 20	11 52	12 24	12 58
30	6 55	5 28	11 23	11 49	12 17	12 46
35	7 07	5 36	11 24	11 48	12 12	12 39
40	7 21	5 43	11 25	11 46	12 08	12 31
45	7 38	5 51	11 27	11 44	12 02	12 22
50	7 59	5 59	11 29	11 42	11 56	12 11
52	8 09	6 02	11 30	11 41	11 53	12 06
54	8 20	6 07	11 31	11 40	11 49	12 01
56	8 32	6 10	11 32	11 39	11 46	11 55
58	8 47	6 14	11 33	11 37	11 42	11 48
60	9 05	6 19	11 34	11 36	11 37	11 40
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 18 h m	19 h m	20 h m	21 h m
72	▭	▭	23 31	23 04	22 32	21 45
70	▭	▭	23 32	23 12	22 49	22 18
68	▭	▭	23 32	23 18	23 02	22 42
66	▭	▭	23 33	23 23	23 13	23 01
64	22 32	////	23 33	23 28	23 22	23 16
62	21 54	////	23 33	23 31	23 30	23 29
60	21 27	////	23 33	23 35	23 37	23 40
58	21 07	////	23 33	23 38	23 43	23 50
56	20 50	////	23 34	23 41	23 48	23 58
54	20 36	////	23 34	23 43	23 53	24 06
52	20 23	////	23 34	23 45	23 58	24 12
50	20 12	////	23 34	23 47	24 02	0 02
45	19 50	22 23	23 34	23 52	24 11	0 11
40	19 32	21 35	23 35	23 56	24 18	0 18
35	19 17	21 04	23 35	23 59	24 24	0 24
30	19 04	20 41	23 35	24 02	0 02	0 30
20	18 42	20 06	23 35	24 07	0 07	0 40
10	18 22	19 40	23 35	24 11	0 11	0 48
0	18 05	19 20	23 36	24 15	0 15	0 56
10	17 47	19 02	23 36	24 19	0 19	1 04
20	17 29	18 48	23 36	24 24	0 24	1 13
30	17 08	18 34	23 36	24 29	0 29	1 23
35	16 55	18 26	23 36	24 32	0 32	1 29
40	16 41	18 19	23 37	24 35	0 35	1 35
45	16 24	18 11	23 37	24 39	0 39	1 43
50	16 03	18 03	23 37	24 44	0 44	1 52
52	15 53	17 59	23 37	24 46	0 46	1 56
54	15 42	17 56	23 37	24 48	0 48	2 01
56	15 30	17 52	23 37	24 51	0 51	2 06
58	15 15	17 48	23 37	24 54	0 54	2 12
60	14 57	17 43	23 37	24 57	0 57	2 19
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
18	17 26	8 54	12 27	10 45	19 33
19	18 06	8 53	12 26	10 42	19 29
20	18 46	8 53	12 25	10 39	19 25
21	19 29	8 53	12 24	10 36	19 21

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	18 ′	19 ′	20 ′
0	12.1	12.1	12.4
4	12.1	12.1	12.4
8	12.2	12.2	12.4
12	12.2	12.2	12.4
16	12.2	12.2	12.5
20	12.3	12.3	12.6
24	12.4	12.4	12.6
28	12.5	12.5	12.7
32	12.6	12.6	12.8
36	12.7	12.7	12.9
40	12.8	12.8	13.0
44	12.9	12.9	13.1
48	13.1	13.1	13.3
52	13.2	13.2	13.4
56	13.4	13.4	13.5
60	13.5	13.5	13.7
64	13.7	13.7	13.9
68	13.9	13.9	14.0
72	14.1	14.1	14.2
76	14.3	14.3	14.4
80	14.4	14.4	14.5
84	14.6	14.6	14.7
88	14.8	14.8	14.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	18 ′	19 ′	20 ′
0	17.5	17.5	17.4
4	17.5	17.5	17.4
8	17.5	17.5	17.3
12	17.4	17.4	17.3
16	17.4	17.4	17.2
20	17.3	17.3	17.2
24	17.2	17.2	17.1
28	17.2	17.2	17.0
32	17.1	17.1	16.9
36	16.9	16.9	16.8
40	16.8	16.8	16.7
44	16.7	16.7	16.6
48	16.6	16.6	16.5
52	16.4	16.4	16.3
56	16.2	16.2	16.2
60	16.1	16.1	16.0
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.0
88	14.9	14.9	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −4.0 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
21 0	268 53.7	226 48.3	+13 06.9	173 53.4	+24 13.1	200 34.8	+21 19.7	68 55.5	− 5 37.5	76 16.0	157	−10 47.1	−124
1	283 56.1	241 48.4	07.5	188 54.0	13.0	215 36.7	19.8	83 58.0	37.5	90 50.7	155	10 59.5	−125
2	298 58.6	256 48.5	08.2	203 54.7	13.0	230 38.5	19.9	99 00.5	37.5	105 25.2	155	11 12.0	−124
3	314 01.0	271 48.7	·· 08.8	218 55.3	·· 12.9	245 40.4	·· 19.9	114 03.0	·· 37.5	119 59.7	155	·11 24.4	−123
4	329 03.5	286 48.8	09.5	233 55.9	12.9	260 42.3	20.0	129 05.5	37.5	134 34.2	153	11 36.7	−123
5	344 06.0	301 48.9	10.1	248 56.6	12.9	275 44.1	20.1	144 07.9	37.5	149 08.5	154	11 49.0	−123
6	359 08.4	316 49.0	+13 10.7	263 57.2	+24 12.8	290 46.0	+21 20.2	159 10.4	− 5 37.5	163 42.9	152	−12 01.3	−123
7	14 10.9	331 49.2	11.4	278 57.9	12.8	305 47.8	20.3	174 12.9	37.6	178 17.1	152	12 13.6	−122
8	29 13.4	346 49.3	12.0	293 58.5	12.7	320 49.7	20.4	189 15.4	37.6	192 51.3	152	12 25.8	−121
9	44 15.8	1 49.4	·· 12.7	308 59.1	·· 12.7	335 51.6	·· 20.5	204 17.8	·· 37.6	207 25.5	150	·12 37.9	−121
10	59 18.3	16 49.6	13.3	323 59.8	12.6	350 53.4	20.5	219 20.3	37.6	221 59.5	150	12 50.0	−121
11	74 20.8	31 49.7	14.0	339 00.4	12.6	5 55.3	20.6	234 22.8	37.6	236 33.5	150	13 02.1	−120
12	89 23.2	46 49.8	+13 14.6	354 01.1	+24 12.5	20 57.2	+21 20.7	249 25.3	− 5 37.6	251 07.5	148	−13 14.1	−120
13	104 25.7	61 49.9	15.3	9 01.7	12.5	35 59.0	20.8	264 27.8	37.6	265 41.3	148	13 26.1	−120
14	119 28.2	76 50.1	15.9	24 02.4	12.4	51 00.9	20.9	279 30.2	37.6	280 15.1	148	13 38.1	−119
15	134 30.6	91 50.2	·· 16.6	39 03.0	·· 12.4	66 02.7	·· 21.0	294 32.7	·· 37.6	294 48.9	146	·13 50.0	−118
16	149 33.1	106 50.3	17.2	54 03.6	12.4	81 04.6	21.1	309 35.2	37.6	309 22.5	146	14 01.8	−118
17	164 35.5	121 50.4	17.9	69 04.3	12.3	96 06.5	21.1	324 37.7	37.6	323 56.1	145	14 13.6	−118
18	179 38.0	136 50.5	+13 18.5	84 04.9	+24 12.3	111 08.3	+21 21.2	339 40.1	− 5 37.6	338 29.6	145	−14 25.4	−117
19	194 40.5	151 50.7	19.2	99 05.6	12.2	126 10.2	21.3	354 42.6	37.6	353 03.1	144	14 37.1	−116
20	209 42.9	166 50.8	19.8	114 06.2	12.2	141 12.1	21.4	9 45.1	37.6	7 36.5	143	14 48.7	−117
21	224 45.4	181 50.9	·· 20.5	129 06.9	·· 12.1	156 13.9	·· 21.5	24 47.6	·· 37.6	22 09.8	142	·15 00.4	−115
22	239 47.9	196 51.0	21.1	144 07.5	12.1	171 15.8	21.6	39 50.0	37.7	36 43.0	141	15 11.9	−115
23	254 50.3	211 51.1	21.8	159 08.2	12.0	186 17.6	21.6	54 52.5	37.7	51 16.1	141	15 23.4	−114
22 0	269 52.8	226 51.2	+13 22.4	174 08.8	+24 12.0	201 19.5	+21 21.7	69 55.0	− 5 37.7	65 49.2	140	−15 34.8	−114
1	284 55.3	241 51.4	23.1	189 09.4	11.9	216 21.4	21.8	84 57.5	37.7	80 22.2	139	15 46.2	−113
2	299 57.7	256 51.5	23.7	204 10.1	11.9	231 23.2	21.9	99 59.9	37.7	94 55.1	138	15 57.5	−113
3	315 00.2	271 51.6	·· 24.4	219 10.7	·· 11.8	246 25.1	·· 22.0	115 02.4	·· 37.7	109 27.9	137	·16 08.8	−112
4	330 02.6	286 51.7	25.0	234 11.4	11.8	261 27.0	22.1	130 04.9	37.7	124 00.6	137	16 20.0	−112
5	345 05.1	301 51.8	25.7	249 12.0	11.7	276 28.8	22.2	145 07.4	37.7	138 33.3	136	16 31.2	−111
6	0 07.6	316 51.9	+13 26.3	264 12.7	+24 11.6	291 30.7	+21 22.2	160 09.8	− 5 37.7	153 05.9	135	−16 42.3	−110
7	15 10.0	331 52.0	27.0	279 13.3	11.6	306 32.5	22.3	175 12.3	37.7	167 38.4	134	16 53.3	−110
8	30 12.5	346 52.1	27.6	294 13.9	11.5	321 34.4	22.4	190 14.8	37.7	182 10.8	133	17 04.3	−109
9	45 15.0	1 52.2	·· 28.3	309 14.6	·· 11.5	336 36.3	·· 22.5	205 17.3	·· 37.7	196 43.1	132	·17 15.2	−108
10	60 17.4	16 52.3	28.9	324 15.2	11.4	351 38.1	22.6	220 19.7	37.7	211 15.3	132	17 26.0	−108
11	75 19.9	31 52.5	29.6	339 15.9	11.4	6 40.0	22.7	235 22.2	37.8	225 47.5	130	17 36.8	−107
12	90 22.4	46 52.6	+13 30.2	354 16.5	+24 11.3	21 41.9	+21 22.7	250 24.7	− 5 37.8	240 19.5	130	−17 47.5	−106
13	105 24.8	61 52.7	30.9	9 17.2	11.3	36 43.7	22.8	265 27.1	37.8	254 51.5	129	17 58.1	−106
14	120 27.3	76 52.8	31.5	24 17.8	11.2	51 45.6	22.9	280 29.6	37.8	269 23.4	128	18 08.7	−104
15	135 29.8	91 52.9	·· 32.2	39 18.5	·· 11.2	66 47.5	·· 23.0	295 32.1	·· 37.8	283 55.2	127	·18 19.1	−105
16	150 32.2	106 53.0	32.8	54 19.1	11.1	81 49.3	23.1	310 34.6	37.8	298 26.9	126	18 29.6	−103
17	165 34.7	121 53.1	33.5	69 19.8	11.0	96 51.2	23.2	325 37.0	37.8	312 58.5	125	18 39.9	−103
18	180 37.1	136 53.2	+13 34.1	84 20.4	+24 11.0	111 53.0	+21 23.2	340 39.5	− 5 37.8	327 30.0	124	−18 50.2	−102
19	195 39.6	151 53.3	34.8	99 21.0	10.9	126 54.9	23.3	355 42.0	37.8	342 01.4	123	19 00.4	−101
20	210 42.1	166 53.4	35.4	114 21.7	10.9	141 56.8	23.4	10 44.5	37.8	356 32.7	123	19 10.5	−100
21	225 44.5	181 53.5	·· 36.1	129 22.3	·· 10.8	156 58.6	·· 23.5	25 46.9	·· 37.8	11 04.0	121	·19 20.5	−100
22	240 47.0	196 53.6	36.7	144 23.0	10.8	172 00.5	23.6	40 49.4	37.8	25 35.1	120	19 30.5	− 99
23	255 49.5	211 53.7	37.4	159 23.6	10.7	187 02.4	23.7	55 51.9	37.9	40 06.1	120	19 40.4	− 98
23 0	270 51.9	226 53.8	+13 38.0	174 24.3	+24 10.6	202 04.2	+21 23.7	70 54.3	− 5 37.9	54 37.1	118	−19 50.2	− 97
1	285 54.4	241 53.8	38.7	189 24.9	10.6	217 06.1	23.8	85 56.8	37.9	69 07.9	118	19 59.9	− 96
2	300 56.9	256 53.9	39.3	204 25.6	10.5	232 08.0	23.9	100 59.3	37.9	83 38.7	116	20 09.5	− 96
3	315 59.3	271 54.0	·· 40.0	219 26.2	·· 10.5	247 09.8	·· 24.0	116 01.8	·· 37.9	98 09.3	116	·20 19.1	− 94
4	331 01.8	286 54.1	40.6	234 26.9	10.4	262 11.7	24.1	131 04.2	37.9	112 39.9	114	20 28.5	− 94
5	346 04.3	301 54.2	41.3	249 27.5	10.3	277 13.6	24.2	146 06.7	37.9	127 10.3	114	20 37.9	− 93
6	1 06.7	316 54.3	+13 41.9	264 28.1	+24 10.3	292 15.4	+21 24.2	161 09.2	− 5 37.9	141 40.7	113	−20 47.2	− 92
7	16 09.2	331 54.4	42.6	279 28.8	10.2	307 17.3	24.3	176 11.6	37.9	156 11.0	111	20 56.4	− 91
8	31 11.6	346 54.5	43.2	294 29.4	10.2	322 19.1	24.4	191 14.1	37.9	170 41.1	111	21 05.5	− 90
9	46 14.1	1 54.6	·· 43.9	309 30.1	·· 10.1	337 21.0	·· 24.5	206 16.6	·· 37.9	185 11.2	109	·21 14.5	− 89
10	61 16.6	16 54.6	44.5	324 30.7	10.0	352 22.9	24.6	221 19.0	38.0	199 41.1	109	21 23.4	− 88
11	76 19.0	31 54.7	45.2	339 31.4	10.0	7 24.7	24.7	236 21.5	38.0	214 11.0	107	21 32.2	− 88
12	91 21.5	46 54.8	+13 45.8	354 32.0	+24 09.9	22 26.6	+21 24.7	251 24.0	− 5 38.0	228 40.7	107	−21 41.0	− 86
13	106 24.0	61 54.9	46.5	9 32.7	09.8	37 28.5	24.8	266 26.4	38.0	243 10.4	106	21 49.6	− 85
14	121 26.4	76 55.0	47.1	24 33.3	09.8	52 30.3	24.9	281 28.9	38.0	257 40.0	104	21 58.1	− 85
15	136 28.9	91 55.1	·· 47.7	39 34.0	·· 09.7	67 32.2	·· 25.0	296 31.4	·· 38.0	272 09.4	104	·22 06.6	− 83
16	151 31.4	106 55.1	48.4	54 34.6	09.6	82 34.1	25.1	311 33.9	38.0	286 38.8	102	22 14.9	− 82
17	166 33.8	121 55.2	49.0	69 35.3	09.6	97 35.9	25.2	326 36.3	38.0	301 08.0	102	22 23.1	− 81
18	181 36.3	136 55.3	+13 49.7	84 35.9	+24 09.5	112 37.8	+21 25.2	341 38.8	− 5 38.0	315 37.2	100	−22 31.2	− 80
19	196 38.8	151 55.4	50.3	99 36.6	09.5	127 39.7	25.3	356 41.3	38.0	330 06.2	100	22 39.2	− 79
20	211 41.2	166 55.5	51.0	114 37.2	09.4	142 41.5	25.4	11 43.7	38.1	344 35.2	98	22 47.1	− 78
21	226 43.7	181 55.5	·· 51.6	129 37.9	·· 09.3	157 43.4	·· 25.5	26 46.2	·· 38.1	359 04.0	98	·22 54.9	− 77
22	241 46.1	196 55.6	52.3	144 38.5	09.3	172 45.3	25.6	41 48.7	38.1	13 32.8	96	23 02.6	− 76
23	256 48.6	211 55.7	52.9	159 39.2	09.2	187 47.1	25.7	56 51.1	38.1	28 01.4	95	23 10.2	− 74
24	271 51.1	226 55.8	+13 53.6	174 39.8	+24 09.1	202 49.0	+21 25.7	71 53.6	− 5 38.1	42 29.9	95	−23 17.6	− 74
code	−	+ 1	+ 7	+ 7	0	+ 18	+ 1	+ 24	0				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
21	0	179 37.8	+23 26.7
	1	194 37.7	26.7
	2	209 37.5	26.7
	3	224 37.4	26.7
	4	239 37.3	26.7
	5	254 37.1	26.7
	6	269 37.0	+23 26.7
	7	284 36.8	26.7
	8	299 36.7	26.8
	9	314 36.6	26.8
	10	329 36.4	26.8
	11	344 36.3	26.8
	12	359 36.2	+23 26.8
	13	14 36.0	26.8
	14	29 35.9	26.8
	15	44 35.8	26.8
	16	59 35.6	26.8
	17	74 35.5	26.8
	18	89 35.4	+23 26.8
	19	104 35.2	26.8
	20	119 35.1	26.8
	21	134 35.0	26.8
	22	149 34.8	26.8
	23	164 34.7	26.8
22	0	179 34.5	+23 26.8
	1	194 34.4	26.8
	2	209 34.3	26.8
	3	224 34.1	26.7
	4	239 34.0	26.7
	5	254 33.9	26.7
	6	269 33.7	+23 26.7
	7	284 33.6	26.7
	8	299 33.5	26.7
	9	314 33.3	26.7
	10	329 33.2	26.7
	11	344 33.1	26.7
	12	359 32.9	+23 26.7
	13	14 32.8	26.6
	14	29 32.7	26.6
	15	44 32.5	26.6
	16	59 32.4	26.6
	17	74 32.2	26.6
	18	89 32.1	+23 26.6
	19	104 32.0	26.5
	20	119 31.8	26.5
	21	134 31.7	26.5
	22	149 31.6	26.5
	23	164 31.4	26.5
23	0	179 31.3	+23 26.4
	1	194 31.2	26.4
	2	209 31.0	26.4
	3	224 30.9	26.4
	4	239 30.8	26.3
	5	254 30.6	26.3
	6	269 30.5	+23 26.3
	7	284 30.4	26.3
	8	299 30.2	26.2
	9	314 30.1	26.2
	10	329 30.0	26.2
	11	344 29.8	26.1
	12	359 29.7	+23 26.1
	13	14 29.6	26.1
	14	29 29.4	26.1
	15	44 29.3	26.0
	16	59 29.2	26.0
	17	74 29.0	26.0
	18	89 28.9	+23 25.9
	19	104 28.8	25.9
	20	119 28.6	25.8
	21	134 28.5	25.8
	22	149 28.4	25.8
	23	164 28.2	25.7
24		179 28.1	+23 25.7
code		—	- 1

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.7	−40 29.1
5	Achernar	336 00.2	−57 28.0
30	Acrux	173 59.9	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.8	+56 12.9
34	Alkaid	153 33.9	+49 32.8
55	Al Na'ir	28 39.8	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.2	+28 50.0
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	353 59.9	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 56.9
22	Avior	234 37.1	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.5	+45 57.2
53	Deneb	50 01.9	+45 06.7
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.0	−18 14.3
27	Dubhe	194 46.7	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.1	+ 9 39.6
56	Fomalhaut	16 13.3	−29 51.9
31	Gacrux	172 51.3	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.7	−60 09.3
6	Hamal	328 51.8	+23 14.6
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 16.7	+74 20.9
57	Markab	14 23.1	+14 57.3
8	Menkar	315 02.4	+ 3 54.6
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.3	−69 31.8
9	Mirfak	309 45.3	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.4	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.2	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.3
39	Zub'g'bi	137 55.1	−15 51.2

GMT h	Equation of Time (App.—Mean) 21 m s	22 m s	23 m s
0	− 1 28.5	− 1 41.6	− 1 54.5
6	− 1 31.8	− 1 44.8	− 1 57.7
12	− 1 35.1	− 1 48.0	− 2 01.0
18	− 1 38.3	− 1 51.3	− 2 04.2
24	− 1 41.6	− 1 54.5	− 2 07.4

Lat. N °	Sunrise h m	Twlt. begins h m
72	▭	▭
70	▭	▭
68	▭	▭
66	▭	▭
64	1 31	////
62	2 09	////
60	2 35	////
58	2 56	////
56	3 13	////
54	3 27	////
52	3 40	////
50	3 51	////
45	4 13	1 40
40	4 31	2 28
35	4 46	2 59
30	4 59	3 22
20	5 21	3 57
10	5 40	4 22
0	5 58	4 43
10	6 16	5 00
20	6 34	5 15
30	6 55	5 29
35	7 08	5 36
40	7 21	5 44
45	7 39	5 51
50	8 00	5 59
52	8 10	6 03
54	8 21	6 06
56	8 33	6 11
58	8 48	6 15
60	9 06	6 19
S		

Lat. N °	Sunset h m	Twlt. ends h m
72	▭	▭
70	▭	▭
68	▭	▭
66	▭	▭
64	22 33	////
62	21 54	////
60	21 28	////
58	21 07	////
56	20 51	////
54	20 36	////
52	20 24	////
50	20 13	////
45	19 50	22 23
40	19 32	21 35
35	19 17	21 04
30	19 04	20 41
20	18 42	20 06
10	18 23	19 41
0	18 06	19 21
10	17 48	19 03
20	17 30	18 49
30	17 08	18 34
35	16 56	18 27
40	16 41	18 19
45	16 25	18 12
50	16 04	18 04
52	15 54	18 00
54	15 43	17 57
56	15 30	17 52
58	15 16	17 49
60	14 58	17 44
S		

Lat. N °	Moonrise 21 h m	22 h m	23 h m	24 h m
72	16 50	▬	▬	▬
70	16 19	19 01	▬	▬
68	15 56	18 03	▬	▬
66	15 39	17 29	19 47	▬
64	15 25	17 05	18 57	21 12
62	15 13	16 46	18 26	20 09
60	15 03	16 31	18 03	19 34
58	14 54	16 18	17 44	19 10
56	14 46	16 06	17 29	18 50
54	14 40	15 57	17 16	18 33
52	14 34	15 48	17 04	18 19
50	14 28	15 40	16 54	18 07
45	14 17	15 23	16 32	17 41
40	14 07	15 10	16 15	17 21
35	13 59	14 58	16 01	17 04
30	13 51	14 48	15 48	16 50
20	13 39	14 32	15 27	16 25
10	13 28	14 17	15 09	16 04
0	13 18	14 03	14 52	15 44
10	13 08	13 49	14 35	15 25
20	12 58	13 35	14 17	15 04
30	12 46	13 18	13 56	14 40
35	12 39	13 09	13 44	14 26
40	12 31	12 58	13 30	14 10
45	12 22	12 45	13 14	13 50
50	12 11	12 30	12 54	13 26
52	12 06	12 23	12 45	13 15
54	12 01	12 15	12 34	13 02
56	11 55	12 06	12 22	12 47
58	11 48	11 56	12 09	12 29
60	11 40	11 45	11 53	12 07

Lat. N °	Moonset 21 h m	22 h m	23 h m	24 h m
72	21 45	▬	▬	▬
70	22 18	21 11	▬	▬
68	22 42	22 10	▬	▬
66	23 01	22 44	22 10	▬
64	23 16	23 09	23 00	22 38
62	23 29	23 29	23 32	23 41
60	23 40	23 46	23 56	24 15
58	23 50	23 59	24 15	0 15
56	23 58	24 11	0 11	0 31
54	24 06	0 06	0 22	0 44
52	24 12	0 12	0 31	0 56
50	0 02	0 19	0 40	1 07
45	0 11	0 32	0 57	1 29
40	0 18	0 43	1 12	1 47
35	0 24	0 52	1 25	2 03
30	0 30	1 00	1 35	2 16
20	0 40	1 15	1 54	2 38
10	0 48	1 27	2 10	2 58
0	0 56	1 39	2 26	3 16
10	1 04	1 51	2 41	3 35
20	1 13	2 04	2 58	3 55
30	1 23	2 19	3 17	4 18
35	1 29	2 27	3 28	4 31
40	1 35	2 37	3 41	4 47
45	1 43	2 48	3 56	5 05
50	1 52	3 02	4 15	5 28
52	1 56	3 09	4 24	5 40
54	2 01	3 16	4 34	5 52
56	2 06	3 24	4 45	6 07
58	2 12	3 33	4 58	6 24
60	2 19	3 44	5 14	6 46

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
21	19 29	8 53	12 24	10 36	19 21
22	20 14	8 53	12 23	10 33	19 17
23	21 04	8 52	12 22	10 30	19 13
24	21 58	8 52	12 21	10 27	19 09

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	21 ′	22 ′	23 ′
0	12.8	13.4	14.3
4	12.8	13.4	14.3
8	12.8	13.4	14.3
12	12.8	13.4	14.3
16	12.9	13.5	14.3
20	12.9	13.5	14.4
24	13.0	13.6	14.4
28	13.0	13.6	14.4
32	13.1	13.7	14.4
36	13.2	13.7	14.5
40	13.3	13.8	14.5
44	13.4	13.9	14.6
48	13.5	14.0	14.6
52	13.7	14.1	14.7
56	13.8	14.2	14.7
60	13.9	14.3	14.8
64	14.1	14.4	14.9
68	14.2	14.5	14.9
72	14.3	14.6	15.0
76	14.5	14.7	15.1
80	14.6	14.9	15.1
84	14.8	15.0	15.2
88	14.9	15.1	15.3
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	21 ′	22 ′	23 ′
0	17.2	16.8	16.3
4	17.1	16.8	16.3
8	17.1	16.8	16.3
12	17.1	16.7	16.2
16	17.0	16.7	16.2
20	17.0	16.7	16.2
24	16.9	16.6	16.2
28	16.9	16.6	16.1
32	16.8	16.5	16.1
36	16.7	16.4	16.1
40	16.6	16.4	16.0
44	16.5	16.3	16.0
48	16.4	16.2	15.9
52	16.2	16.1	15.9
56	16.1	16.0	15.8
60	16.0	15.9	15.7
64	15.8	15.8	15.7
68	15.7	15.7	15.6
72	15.6	15.6	15.6
76	15.4	15.4	15.5
80	15.3	15.3	15.4
84	15.1	15.2	15.3
88	15.0	15.1	15.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.5 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
24 h 0	271 51.1	226 55.8	+13 53.6	174 39.8	+24 09.1	202 49.0	+21 25.7	71 53.6	− 5 38.1	42 29.9	95	−23 17.6	− 74
1	286 53.5	241 55.8	54.2	189 40.4	09.0	217 50.9	25.8	86 56.1	38.1	56 58.4	93	23 25.0	− 72
2	301 56.0	256 55.9	54.9	204 41.1	09.0	232 52.7	25.9	101 58.5	38.1	71 26.7	93	23 32.2	− 71
3	316 58.5	271 56.0	•• 55.5	219 41.7	•• 08.9	247 54.6	•• 26.0	117 01.0	•• 38.1	85 55.0	91	•23 39.3	− 70
4	332 00.9	286 56.0	56.2	234 42.4	08.8	262 56.5	26.1	132 03.5	38.1	100 23.1	90	23 46.3	− 69
5	347 03.4	301 56.1	56.8	249 43.0	08.8	277 58.3	26.1	147 05.9	38.2	114 51.1	90	23 53.2	− 68
6	2 05.9	316 56.2	+13 57.5	264 43.7	+24 08.7	293 00.2	+21 26.2	162 08.4	− 5 38.2	129 19.1	88	−24 00.0	− 66
7	17 08.3	331 56.2	58.1	279 44.3	08.6	308 02.0	26.3	177 10.9	38.2	143 46.9	88	24 06.6	− 65
8	32 10.8	346 56.3	58.8	294 45.0	08.6	323 03.9	26.4	192 13.3	38.2	158 14.7	86	24 13.1	− 64
9	47 13.2	1 56.4	•13 59.4	309 45.6	•• 08.5	338 05.8	•• 26.5	207 15.8	•• 38.2	172 42.3	86	•24 19.5	− 63
10	62 15.7	16 56.4	14 00.1	324 46.3	08.4	353 07.6	26.6	222 18.3	38.2	187 09.9	84	24 25.8	− 61
11	77 18.2	31 56.5	00.7	339 46.9	08.4	8 09.5	26.6	237 20.7	38.2	201 37.3	84	24 31.9	− 60
12	92 20.6	46 56.6	+14 01.4	354 47.6	+24 08.3	23 11.4	+21 26.7	252 23.2	− 5 38.2	216 04.7	82	−24 37.9	− 59
13	107 23.1	61 56.6	02.0	9 48.2	08.2	38 13.2	26.8	267 25.7	38.2	230 31.9	82	24 43.8	− 57
14	122 25.6	76 56.7	02.7	24 48.9	08.1	53 15.1	26.9	282 28.1	38.3	244 59.1	81	24 49.5	− 56
15	137 28.0	91 56.8	•• 03.3	39 49.5	•• 08.1	68 17.0	•• 27.0	297 30.6	•• 38.3	259 26.2	79	•24 55.1	− 55
16	152 30.5	106 56.8	04.0	54 50.2	08.0	83 18.8	27.0	312 33.1	38.3	273 53.1	79	25 00.6	− 54
17	167 33.0	121 56.9	04.6	69 50.8	07.9	98 20.7	27.1	327 35.5	38.3	288 20.0	78	25 06.0	− 52
18	182 35.4	136 56.9	+14 05.3	84 51.5	+24 07.8	113 22.6	+21 27.2	342 38.0	− 5 38.3	302 46.8	77	−25 11.2	− 50
19	197 37.9	151 57.0	05.9	99 52.1	07.8	128 24.4	27.3	357 40.4	38.3	317 13.5	76	25 16.2	− 50
20	212 40.4	166 57.1	06.6	114 52.8	07.7	143 26.3	27.4	12 42.9	38.3	331 40.1	76	25 21.2	− 48
21	227 42.8	181 57.1	•• 07.2	129 53.4	•• 07.6	158 28.2	•• 27.5	27 45.4	•• 38.3	346 06.7	74	•25 26.0	− 46
22	242 45.3	196 57.2	07.9	144 54.1	07.5	173 30.0	27.5	42 47.8	38.3	0 33.1	73	25 30.6	− 45
23	257 47.7	211 57.2	08.5	159 54.7	07.5	188 31.9	27.6	57 50.3	38.4	14 59.4	73	25 35.1	− 44
25 0	272 50.2	226 57.3	+14 09.2	174 55.4	+24 07.4	203 33.8	+21 27.7	72 52.8	− 5 38.4	29 25.7	72	−25 39.5	− 42
1	287 52.7	241 57.3	09.8	189 56.0	07.3	218 35.6	27.8	87 55.2	38.4	43 51.9	71	25 43.7	− 41
2	302 55.1	256 57.4	10.5	204 56.7	07.2	233 37.5	27.9	102 57.7	38.4	58 18.0	70	25 47.8	− 39
3	317 57.6	271 57.4	•• 11.1	219 57.3	•• 07.2	248 39.4	•• 27.9	118 00.2	•• 38.4	72 44.0	69	•25 51.7	− 38
4	333 00.1	286 57.5	11.8	234 58.0	07.1	263 41.2	28.0	133 02.6	38.4	87 09.9	69	25 55.5	− 37
5	348 02.5	301 57.5	12.4	249 58.6	07.0	278 43.1	28.1	148 05.1	38.4	101 35.8	68	25 59.2	− 34
6	3 05.0	316 57.6	+14 13.1	264 59.3	+24 06.9	293 45.0	+21 28.2	163 07.5	− 5 38.4	116 01.6	67	−26 02.6	− 34
7	18 07.5	331 57.6	13.7	279 59.9	06.9	308 46.8	28.3	178 10.0	38.5	130 27.3	66	26 06.0	− 32
8	33 09.9	346 57.7	14.4	295 00.6	06.8	323 48.7	28.3	193 12.5	38.5	144 52.9	66	26 09.2	− 30
9	48 12.4	1 57.7	•• 15.0	310 01.2	•• 06.7	338 50.6	•• 28.4	208 14.9	•• 38.5	159 18.5	64	•26 12.2	− 29
10	63 14.9	16 57.8	15.7	325 01.9	06.6	353 52.5	28.5	223 17.4	38.5	173 43.9	64	26 15.1	− 27
11	78 17.3	31 57.8	16.3	340 02.5	06.5	8 54.3	28.6	238 19.9	38.5	188 09.3	64	26 17.8	− 25
12	93 19.8	46 57.9	+14 17.0	355 03.2	+24 06.5	23 56.2	+21 28.7	253 22.3	− 5 38.5	202 34.7	63	−26 20.3	− 24
13	108 22.2	61 57.9	17.6	10 03.9	06.4	38 58.1	28.7	268 24.8	38.5	217 00.0	62	26 22.7	− 23
14	123 24.7	76 57.9	18.2	25 04.5	06.3	53 59.9	28.8	283 27.2	38.5	231 25.2	61	26 25.0	− 21
15	138 27.2	91 58.0	•• 18.9	40 05.2	•• 06.2	69 01.8	•• 28.9	298 29.7	•• 38.6	245 50.3	61	•26 27.1	− 19
16	153 29.6	106 58.0	19.5	55 05.8	06.1	84 03.7	29.0	313 32.2	38.6	260 15.4	60	26 29.0	− 18
17	168 32.1	121 58.1	20.2	70 06.5	06.1	99 05.5	29.1	328 34.6	38.6	274 40.4	60	26 30.8	− 16
18	183 34.6	136 58.1	+14 20.8	85 07.1	+24 06.0	114 07.4	+21 29.1	343 37.1	− 5 38.6	289 05.4	59	−26 32.4	− 14
19	198 37.0	151 58.1	21.5	100 07.8	05.9	129 09.3	29.2	358 39.5	38.6	303 30.3	58	26 33.8	− 13
20	213 39.5	166 58.2	22.1	115 08.4	05.8	144 11.1	29.3	13 42.0	38.6	317 55.1	58	26 35.1	− 11
21	228 42.0	181 58.2	•• 22.8	130 09.1	•• 05.7	159 13.0	•• 29.4	28 44.5	•• 38.6	332 19.9	58	•26 36.2	− 10
22	243 44.4	196 58.2	23.4	145 09.7	05.6	174 14.9	29.5	43 46.9	38.7	346 44.7	57	26 37.2	− 7
23	258 46.9	211 58.3	24.1	160 10.4	05.6	189 16.7	29.5	58 49.4	38.7	1 09.4	56	26 37.9	− 7
26 0	273 49.4	226 58.3	+14 24.7	175 11.0	+24 05.5	204 18.6	+21 29.6	73 51.8	− 5 38.7	15 34.0	56	−26 38.6	− 4
1	288 51.8	241 58.3	25.4	190 11.7	05.4	219 20.5	29.7	88 54.3	38.7	29 58.6	56	26 39.0	− 3
2	303 54.3	256 58.4	26.0	205 12.3	05.3	234 22.3	29.8	103 56.8	38.7	44 23.2	55	26 39.3	− 1
3	318 56.7	271 58.4	•• 26.7	220 13.0	•• 05.2	249 24.2	•• 29.9	118 59.2	•• 38.7	58 47.7	55	•26 39.4	0
4	333 59.2	286 58.4	27.3	235 13.6	05.1	264 26.1	29.9	134 01.7	38.7	73 12.2	54	26 39.4	+ 3
5	349 01.7	301 58.5	28.0	250 14.3	05.1	279 27.9	30.0	149 04.1	38.7	87 36.6	54	26 39.1	+ 3
6	4 04.1	316 58.5	+14 28.6	265 14.9	+24 05.0	294 29.8	+21 30.1	164 06.6	− 5 38.8	102 01.0	54	−26 38.8	+ 6
7	19 06.6	331 58.5	29.3	280 15.6	04.9	309 31.7	30.2	179 09.1	38.8	116 25.4	53	26 38.2	+ 7
8	34 09.1	346 58.6	29.9	295 16.3	04.8	324 33.5	30.3	194 11.5	38.8	130 49.7	54	26 37.5	+ 9
9	49 11.5	1 58.6	•• 30.5	310 16.9	•• 04.7	339 35.4	•• 30.3	209 14.0	•• 38.8	145 14.1	52	•26 36.6	+ 11
10	64 14.0	16 58.6	31.2	325 17.6	04.6	354 37.3	30.4	224 16.4	38.8	159 38.3	53	26 35.5	+ 12
11	79 16.5	31 58.6	31.8	340 18.2	04.5	9 39.2	30.5	239 18.9	38.8	174 02.6	53	26 34.3	+ 14
12	94 18.9	46 58.7	+14 32.5	355 18.9	+24 04.4	24 41.0	+21 30.6	254 21.3	− 5 38.8	188 26.9	52	−26 32.9	+ 16
13	109 21.4	61 58.7	33.1	10 19.5	04.4	39 42.9	30.7	269 23.8	38.9	202 51.1	52	26 31.3	+ 18
14	124 23.9	76 58.7	33.8	25 20.2	04.3	54 44.8	30.7	284 26.3	38.9	217 15.3	52	26 29.5	+ 19
15	139 26.3	91 58.7	•• 34.4	40 20.8	•• 04.2	69 46.6	•• 30.8	299 28.7	•• 38.9	231 39.5	51	•26 27.6	+ 21
16	154 28.8	106 58.7	35.1	55 21.5	04.1	84 48.5	30.9	314 31.2	38.9	246 03.6	52	26 25.5	+ 23
17	169 31.2	121 58.8	35.7	70 22.1	04.0	99 50.4	31.0	329 33.6	38.9	260 27.8	51	26 23.2	+ 24
18	184 33.7	136 58.8	+14 36.4	85 22.8	+24 03.9	114 52.2	+21 31.1	344 36.1	− 5 38.9	274 51.9	52	−26 20.8	+ 27
19	199 36.2	151 58.8	37.0	100 23.5	03.8	129 54.1	31.1	359 38.5	39.0	289 16.1	51	26 18.1	+ 27
20	214 38.6	166 58.8	37.6	115 24.1	03.7	144 56.0	31.2	14 41.0	39.0	303 40.2	51	26 15.4	+ 30
21	229 41.1	181 58.8	•• 38.3	130 24.8	•• 03.6	159 57.9	•• 31.3	29 43.5	•• 39.0	318 04.3	52	•26 12.4	+ 31
22	244 43.6	196 58.8	38.9	145 25.4	03.5	174 59.7	31.4	44 45.9	39.0	332 28.5	51	26 09.3	+ 33
23	259 46.0	211 58.9	39.6	160 26.1	03.5	190 01.6	31.5	59 48.4	39.0	346 52.6	51	26 06.0	+ 35
24	274 48.5	226 58.9	+14 40.2	175 26.7	+24 03.4	205 03.5	+21 31.5	74 50.8	− 5 39.0	1 16.7	52	−26 02.5	+ 37
code	−	0	+ 6	+ 7	− 1	+ 19	0	+ 25	0				

GMT	h	SUN GHA ° ′	Dec. ° ′
24	0	179 28.1	+23 25.7
	1	194 28.0	25.7
	2	209 27.8	25.6
	3	224 27.7	25.6
	4	239 27.6	25.5
	5	254 27.4	25.5
	6	269 27.3	+23 25.4
	7	284 27.2	25.4
	8	299 27.0	25.4
	9	314 26.9	25.3
	10	329 26.8	25.3
	11	344 26.6	25.2
	12	359 26.5	+23 25.2
	13	14 26.4	25.1
	14	29 26.2	25.1
	15	44 26.1	25.0
	16	59 26.0	25.0
	17	74 25.8	24.9
	18	89 25.7	+23 24.9
	19	104 25.6	24.8
	20	119 25.4	24.8
	21	134 25.3	24.7
	22	149 25.2	24.7
	23	164 25.0	24.6
25	0	179 24.9	+23 24.5
	1	194 24.8	24.5
	2	209 24.6	24.4
	3	224 24.5	24.4
	4	239 24.4	24.3
	5	254 24.2	24.3
	6	269 24.1	+23 24.2
	7	284 24.0	24.1
	8	299 23.8	24.1
	9	314 23.7	24.0
	10	329 23.6	23.9
	11	344 23.4	23.9
	12	359 23.3	+23 23.8
	13	14 23.2	23.8
	14	29 23.0	23.7
	15	44 22.9	23.6
	16	59 22.8	23.5
	17	74 22.6	23.5
	18	89 22.5	+23 23.4
	19	104 22.4	23.3
	20	119 22.3	23.3
	21	134 22.1	23.2
	22	149 22.0	23.1
	23	164 21.9	23.1
26	0	179 21.7	+23 23.0
	1	194 21.6	22.9
	2	209 21.5	22.8
	3	224 21.3	22.8
	4	239 21.2	22.7
	5	254 21.1	22.6
	6	269 20.9	+23 22.5
	7	284 20.8	22.5
	8	299 20.7	22.4
	9	314 20.5	22.3
	10	329 20.4	22.2
	11	344 20.3	22.1
	12	359 20.2	+23 22.0
	13	14 20.0	22.0
	14	29 19.9	21.9
	15	44 19.8	21.8
	16	59 19.6	21.7
	17	74 19.5	21.6
	18	89 19.4	+23 21.5
	19	104 19.2	21.5
	20	119 19.1	21.4
	21	134 19.0	21.3
	22	149 18.9	21.2
	23	164 18.7	21.1
	24	179 18.6	+23 21.0
code		—	0

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.6	−40 29.1
5	Achernar	336 00.2	−57 28.0
30	Acrux	173 59.9	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.4	+16 25.1
32	Alioth	166 59.8	+56 12.9
34	Alkaid	153 33.9	+49 32.8
55	Al Na'ir	28 39.7	−47 11.0
15	Alnilam	276 32.4	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.2	+28 50.0
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	353 59.9	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 02.9	−68 56.9
22	Avior	234 37.2	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.5	+45 57.2
53	Deneb	50 01.8	+45 06.7
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.0	−18 14.3
27	Dubhe	194 46.7	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.1	+ 9 39.7
56	Fomalhaut	16 13.3	−29 51.9
31	Gacrux	172 51.3	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.7	−60 09.4
6	Hamal	328 51.8	+23 14.6
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 16.8	+74 20.9
57	Markab	14 23.1	+14 57.3
8	Menkar	315 02.3	+ 3 54.6
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.3	−69 31.8
9	Mirfak	309 45.3	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.4	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.2	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.3
39	Zub'g'bi	137 55.1	−15 51.2

GMT h	Equation of Time (App.—Mean) 24 m s	25 m s	26 m s
0	− 2 07.4	− 2 20.2	− 2 32.8
6	− 2 10.6	− 2 23.3	− 2 36.0
12	− 2 13.8	− 2 26.5	− 2 39.1
18	− 2 17.0	− 2 29.7	− 2 42.3
24	− 2 20.2	− 2 32.8	− 2 45.4

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 24 h m	25 h m	26 h m	27 h m
72	▭	▭	■	■	■	■
70	▭	▭	■	■	■	■
68	▭	▭	■	■	■	■
66	▭	▭	■	■	■	■
64	1 33	////	21 12	■	■	23 15
62	2 11	////	20 09	21 38	22 24	22 38
60	2 37	////	19 34	20 54	21 45	22 12
58	2 57	////	19 10	20 24	21 18	21 51
56	3 14	////	18 50	20 02	20 57	21 34
54	3 28	////	18 33	19 43	20 39	21 19
52	3 41	////	18 19	19 28	20 24	21 07
50	3 52	////	18 07	19 14	20 11	20 55
45	4 14	1 41	17 41	18 46	19 44	20 32
40	4 32	2 29	17 21	18 25	19 23	20 13
35	4 47	3 00	17 04	18 07	19 05	19 57
30	5 00	3 23	16 50	17 51	18 50	19 43
20	5 22	3 58	16 25	17 25	18 24	19 19
10	5 41	4 23	16 04	17 02	18 01	18 59
0	5 59	4 44	15 44	16 41	17 40	18 40
10	6 16	5 01	15 25	16 20	17 20	18 21
20	6 35	5 16	15 04	15 58	16 57	18 00
30	6 56	5 30	14 40	15 32	16 31	17 36
35	7 08	5 37	14 26	15 16	16 16	17 22
40	7 22	5 45	14 10	14 59	15 58	17 06
45	7 39	5 52	13 50	14 38	15 37	16 47
50	8 00	6 00	13 26	14 11	15 10	16 22
52	8 10	6 04	13 15	13 58	14 56	16 10
54	8 21	6 07	13 02	13 43	14 41	15 57
56	8 34	6 12	12 47	13 25	14 23	15 41
58	8 48	6 15	12 29	13 04	14 02	15 23
60	9 06	6 20	12 07	12 37	13 33	15 00
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 24 h m	25 h m	26 h m	27 h m
72	▭	▭	■	■	■	■
70	▭	▭	■	■	■	■
68	▭	▭	■	■	■	■
66	▭	▭	■	■	■	■
64	22 32	////	22 38	■	■	■
62	21 54	////	23 41	24 12	0 12	1 30
60	21 28	////	24 15	0 15	0 56	2 08
58	21 07	////	0 15	0 41	1 25	2 35
56	20 51	////	0 31	1 01	1 48	2 56
54	20 36	////	0 44	1 18	2 06	3 14
52	20 24	////	0 56	1 32	2 22	3 29
50	20 13	////	1 07	1 45	2 36	3 42
45	19 51	22 24	1 29	2 11	3 03	4 08
40	19 33	21 36	1 47	2 31	3 25	4 29
35	19 18	21 05	2 03	2 49	3 43	4 47
30	19 05	20 42	2 16	3 04	3 59	5 02
20	18 43	20 07	2 38	3 29	4 25	5 27
10	18 24	19 42	2 58	3 51	4 48	5 49
0	18 06	19 21	3 16	4 11	5 09	6 09
10	17 49	19 04	3 35	4 32	5 30	6 29
20	17 30	18 49	3 55	4 54	5 53	6 51
30	17 09	18 34	4 18	5 19	6 19	7 16
35	16 57	18 28	4 31	5 34	6 35	7 30
40	16 42	18 20	4 47	5 52	6 53	7 47
45	16 26	18 13	5 05	6 12	7 14	8 07
50	16 05	18 04	5 28	6 39	7 42	8 32
52	15 55	18 01	5 40	6 52	7 55	8 44
54	15 44	17 57	5 52	7 07	8 10	8 58
56	15 31	17 53	6 07	7 24	8 28	9 14
58	15 17	17 50	6 24	7 45	8 50	9 33
60	14 59	17 45	6 46	8 12	9 18	9 56
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
24	21 58	8 52	12 21	10 27	19 09
25	22 55	8 52	12 20	10 25	19 05
26	23 55	8 52	12 19	10 22	19 01
27	24 54	8 52	12 18	10 19	18 58

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	24 ′	25 ′	26 ′
0	15.2	16.1	16.9
4	15.2	16.1	16.9
8	15.2	16.1	16.9
12	15.2	16.0	16.9
16	15.2	16.0	16.9
20	15.2	16.0	16.9
24	15.2	16.0	16.8
28	15.2	16.0	16.8
32	15.2	16.0	16.8
36	15.2	16.0	16.7
40	15.2	16.0	16.7
44	15.3	15.9	16.6
48	15.3	15.9	16.6
52	15.3	15.9	16.5
56	15.3	15.9	16.4
60	15.3	15.8	16.4
64	15.3	15.8	16.3
68	15.4	15.8	16.2
72	15.4	15.8	16.2
76	15.4	15.7	16.1
80	15.4	15.7	16.0
84	15.4	15.7	15.9
88	15.5	15.7	15.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	24 ′	25 ′	26 ′
0	15.8	15.3	14.8
4	15.8	15.3	14.8
8	15.8	15.3	14.8
12	15.8	15.3	14.8
16	15.8	15.3	14.8
20	15.7	15.3	14.8
24	15.7	15.3	14.9
28	15.7	15.3	14.9
32	15.7	15.3	14.9
36	15.7	15.3	15.0
40	15.7	15.4	15.0
44	15.7	15.4	15.1
48	15.7	15.4	15.1
52	15.6	15.4	15.2
56	15.6	15.4	15.3
60	15.6	15.5	15.3
64	15.6	15.5	15.4
68	15.6	15.5	15.5
72	15.6	15.5	15.5
76	15.5	15.6	15.6
80	15.5	15.6	15.7
84	15.5	15.6	15.8
88	15.5	15.7	15.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.9 GHA	VENUS −3.9 Dec.	MARS 1.8 GHA	MARS 1.8 Dec.	JUPITER −1.5 GHA	JUPITER −1.5 Dec.	SATURN 0.9 GHA	SATURN 0.9 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
27 0	274 48.5	226 58.9	+14 40.2	175 26.7	+24 03.4	205 03.5	+21 31.5	74 50.8	− 5 39.0	1 16.7	52	−26 02.5	+ 37
1	289 51.0	241 58.9	40.9	190 27.4	03.3	220 05.3	31.6	89 53.3	39.0	15 40.9	51	25 58.8	+ 38
2	304 53.4	256 58.9	41.5	205 28.0	03.2	235 07.2	31.7	104 55.7	39.1	30 05.0	52	25 55.0	+ 40
3	319 55.9	271 58.9	•• 42.2	220 28.7	•• 03.1	250 09.1	•• 31.8	119 58.2	•• 39.1	44 29.2	51	•25 51.0	+ 42
4	334 58.3	286 58.9	42.8	235 29.4	03.0	265 10.9	31.9	135 00.6	39.1	58 53.3	52	25 46.8	+ 43
5	350 00.8	301 58.9	43.5	250 30.0	02.9	280 12.8	31.9	150 03.1	39.1	73 17.5	52	25 42.5	+ 45
6	5 03.3	316 58.9	+14 44.1	265 30.7	+24 02.8	295 14.7	+21 32.0	165 05.6	− 5 39.1	87 41.7	52	−25 38.0	+ 47
7	20 05.7	331 58.9	44.7	280 31.3	02.7	310 16.5	32.1	180 08.0	39.1	102 05.9	52	25 33.3	+ 48
8	35 08.2	346 58.9	45.4	295 32.0	02.6	325 18.4	32.2	195 10.5	39.1	116 30.1	53	25 28.5	+ 50
9	50 10.7	1 59.0	•• 46.0	310 32.6	•• 02.5	340 20.3	•• 32.2	210 12.9	•• 39.2	130 54.4	53	•25 23.5	+ 52
10	65 13.1	16 59.0	46.7	325 33.3	02.4	355 22.2	32.3	225 15.4	39.2	145 18.7	53	25 18.3	+ 54
11	80 15.6	31 59.0	47.3	340 33.9	02.3	10 24.0	32.4	240 17.8	39.2	159 43.0	53	25 12.9	+ 55
12	95 18.1	46 59.0	+14 48.0	355 34.6	+24 02.2	25 25.9	+21 32.5	255 20.3	− 5 39.2	174 07.3	53	−25 07.4	+ 57
13	110 20.5	61 59.0	48.6	10 35.3	02.1	40 27.8	32.6	270 22.7	39.2	188 31.6	54	25 01.7	+ 58
14	125 23.0	76 59.0	49.2	25 35.9	02.0	55 29.6	32.6	285 25.2	39.2	202 56.0	54	24 55.9	+ 61
15	140 25.5	91 59.0	•• 49.9	40 36.6	•• 01.9	70 31.5	•• 32.7	300 27.6	•• 39.3	217 20.4	55	•24 49.8	+ 61
16	155 27.9	106 59.0	50.5	55 37.2	01.8	85 33.4	32.8	315 30.1	39.3	231 44.9	55	24 43.7	+ 64
17	170 30.4	121 59.0	51.2	70 37.9	01.7	100 35.3	32.9	330 32.5	39.3	246 09.4	55	24 37.3	+ 65
18	185 32.8	136 59.0	+14 51.8	85 38.5	+24 01.6	115 37.1	+21 32.9	345 35.0	− 5 39.3	260 33.9	56	−24 30.8	+ 67
19	200 35.3	151 59.0	52.5	100 39.2	01.5	130 39.0	33.0	0 37.5	39.3	274 58.5	56	24 24.1	+ 68
20	215 37.8	166 59.0	53.1	115 39.9	01.4	145 40.9	33.1	15 39.9	39.3	289 23.1	56	24 17.3	+ 70
21	230 40.2	181 59.0	•• 53.7	130 40.5	•• 01.3	160 42.7	•• 33.2	30 42.4	•• 39.4	303 47.7	57	•24 10.3	+ 72
22	245 42.7	196 59.0	54.4	145 41.2	01.2	175 44.6	33.3	45 44.8	39.4	318 12.4	57	24 03.1	+ 73
23	260 45.2	211 59.0	55.0	160 41.8	01.1	190 46.5	33.3	60 47.3	39.4	332 37.1	58	23 55.8	+ 75
28 0	275 47.6	226 59.0	+14 55.7	175 42.5	+24 01.0	205 48.4	+21 33.4	75 49.7	− 5 39.4	347 01.9	59	−23 48.3	+ 76
1	290 50.1	241 58.9	56.3	190 43.2	00.9	220 50.2	33.5	90 52.2	39.4	1 26.8	58	23 40.7	+ 78
2	305 52.6	256 58.9	57.0	205 43.8	00.8	235 52.1	33.6	105 54.6	39.4	15 51.6	60	23 32.9	+ 79
3	320 55.0	271 58.9	•• 57.6	220 44.5	•• 00.7	250 54.0	•• 33.6	120 57.1	•• 39.5	30 16.6	60	•23 25.0	+ 81
4	335 57.5	286 58.9	58.2	235 45.1	00.6	265 55.8	33.7	135 59.5	39.5	44 41.6	60	23 16.9	+ 83
5	351 00.0	301 58.9	58.9	250 45.8	00.5	280 57.7	33.8	151 02.0	39.5	59 06.6	61	23 08.6	+ 84
6	6 02.4	316 58.9	+14 59.5	265 46.4	+24 00.4	295 59.6	+21 33.9	166 04.4	− 5 39.5	73 31.7	61	−23 00.2	+ 86
7	21 04.9	331 58.9	15 00.2	280 47.1	00.3	311 01.5	34.0	181 06.9	39.5	87 56.8	62	22 51.6	+ 87
8	36 07.3	346 58.9	00.8	295 47.8	00.2	326 03.3	34.0	196 09.3	39.5	102 22.0	63	22 42.9	+ 88
9	51 09.8	1 58.9	•• 01.4	310 48.4	•• 00.1	341 05.2	•• 34.1	211 11.8	•• 39.6	116 47.3	63	•22 34.1	+ 90
10	66 12.3	16 58.8	02.1	325 49.1	24 00.0	356 07.1	34.2	226 14.2	39.6	131 12.6	64	22 25.1	+ 92
11	81 14.7	31 58.8	02.7	340 49.7	23 59.9	11 08.9	34.3	241 16.7	39.6	145 38.0	64	22 15.9	+ 93
12	96 17.2	46 58.8	+15 03.4	355 50.4	+23 59.8	26 10.8	+21 34.3	256 19.1	− 5 39.6	160 03.4	65	−22 06.6	+ 94
13	111 19.7	61 58.8	04.0	10 51.1	59.7	41 12.7	34.4	271 21.6	39.6	174 28.9	66	21 57.2	+ 96
14	126 22.1	76 58.8	04.6	25 51.7	59.6	56 14.6	34.5	286 24.0	39.6	188 54.5	66	21 47.6	+ 97
15	141 24.6	91 58.8	•• 05.3	40 52.4	•• 59.5	71 16.4	•• 34.6	301 26.5	•• 39.7	203 20.1	67	•21 37.9	+ 99
16	156 27.1	106 58.7	05.9	55 53.0	59.4	86 18.3	34.7	316 28.9	39.7	217 45.8	68	21 28.0	+100
17	171 29.5	121 58.7	06.6	70 53.7	59.3	101 20.2	34.7	331 31.4	39.7	232 11.6	68	21 18.0	+101
18	186 32.0	136 58.7	+15 07.2	85 54.4	+23 59.2	116 22.0	+21 34.8	346 33.8	− 5 39.7	246 37.4	69	−21 07.9	+103
19	201 34.5	151 58.7	07.8	100 55.0	59.1	131 23.9	34.9	1 36.3	39.7	261 03.3	70	20 57.6	+104
20	216 36.9	166 58.7	08.5	115 55.7	59.0	146 25.8	35.0	16 38.7	39.8	275 29.3	70	20 47.2	+106
21	231 39.4	181 58.6	•• 09.1	130 56.3	•• 58.9	161 27.7	•• 35.0	31 41.2	•• 39.8	289 55.3	71	•20 36.6	+107
22	246 41.8	196 58.6	09.8	145 57.0	58.7	176 29.5	35.1	46 43.6	39.8	304 21.4	72	20 25.9	+108
23	261 44.3	211 58.6	10.4	160 57.7	58.6	191 31.4	35.2	61 46.1	39.8	318 47.6	72	20 15.1	+109
29 0	276 46.8	226 58.6	+15 11.0	175 58.3	+23 58.5	206 33.3	+21 35.3	76 48.5	− 5 39.8	333 13.8	73	−20 04.2	+111
1	291 49.2	241 58.5	11.7	190 59.0	58.4	221 35.2	35.3	91 51.0	39.8	347 40.1	74	19 53.1	+112
2	306 51.7	256 58.5	12.3	205 59.6	58.3	236 37.0	35.4	106 53.4	39.9	2 06.5	74	19 41.9	+113
3	321 54.2	271 58.5	•• 13.0	221 00.3	•• 58.2	251 38.9	•• 35.5	121 55.9	•• 39.9	16 32.9	76	•19 30.6	+114
4	336 56.6	286 58.5	13.6	236 01.0	58.1	266 40.8	35.6	136 58.3	39.9	30 59.5	76	19 19.2	+116
5	351 59.1	301 58.4	14.2	251 01.6	58.0	281 42.6	35.7	152 00.8	39.9	45 26.1	76	19 07.6	+116
6	7 01.6	316 58.4	+15 14.9	266 02.3	+23 57.9	296 44.5	+21 35.7	167 03.2	− 5 39.9	59 52.7	78	−18 56.0	+118
7	22 04.0	331 58.4	15.5	281 02.9	57.8	311 46.4	35.8	182 05.6	40.0	74 19.5	78	18 44.2	+120
8	37 06.5	346 58.3	16.1	296 03.6	57.6	326 48.3	35.9	197 08.1	40.0	88 46.3	78	18 32.2	+120
9	52 08.9	1 58.3	•• 16.8	311 04.3	•• 57.5	341 50.1	•• 36.0	212 10.5	•• 40.0	103 13.1	80	•18 20.2	+121
10	67 11.4	16 58.3	17.4	326 04.9	57.4	356 52.0	36.0	227 13.0	40.0	117 40.1	80	18 08.1	+123
11	82 13.9	31 58.2	18.1	341 05.6	57.3	11 53.9	36.1	242 15.4	40.0	132 07.1	81	17 55.8	+124
12	97 16.3	46 58.2	+15 18.7	356 06.3	+23 57.2	26 55.8	+21 36.2	257 17.9	− 5 40.1	146 34.2	82	−17 43.4	+124
13	112 18.8	61 58.2	19.3	11 06.9	57.1	41 57.6	36.3	272 20.3	40.1	161 01.4	82	17 31.0	+126
14	127 21.3	76 58.1	20.0	26 07.6	57.0	56 59.5	36.3	287 22.8	40.1	175 28.6	83	17 18.4	+127
15	142 23.7	91 58.1	•• 20.6	41 08.2	•• 56.9	72 01.4	•• 36.4	302 25.2	•• 40.1	189 55.9	84	•17 05.7	+128
16	157 26.2	106 58.0	21.2	56 08.9	56.7	87 03.3	36.5	317 27.7	40.1	204 23.3	84	16 52.9	+129
17	172 28.7	121 58.0	21.9	71 09.6	56.6	102 05.1	36.6	332 30.1	40.1	218 50.7	85	16 40.0	+130
18	187 31.1	136 58.0	+15 22.5	86 10.2	+23 56.5	117 07.0	+21 36.6	347 32.6	− 5 40.2	233 18.2	86	−16 27.0	+131
19	202 33.6	151 57.9	23.1	101 10.9	56.4	132 08.9	36.7	2 35.0	40.2	247 45.8	87	16 13.9	+132
20	217 36.1	166 57.9	23.8	116 11.5	56.3	147 10.8	36.8	17 37.4	40.2	262 13.5	87	16 00.7	+133
21	232 38.5	181 57.8	•• 24.4	131 12.2	•• 56.2	162 12.6	•• 36.9	32 39.9	•• 40.2	276 41.2	88	•15 47.4	+133
22	247 41.0	196 57.8	25.0	146 12.9	56.1	177 14.5	36.9	47 42.3	40.2	291 09.0	89	15 34.1	+135
23	262 43.4	211 57.8	25.7	161 13.5	55.9	192 16.4	37.0	62 44.8	40.3	305 36.9	89	15 20.6	+136
24	277 45.9	226 57.7	+15 26.3	176 14.2	+23 55.8	207 18.3	+21 37.1	77 47.2	− 5 40.3	320 04.8	90	−15 07.0	+136
code	−	0	+ 6	+ 7	− 1	+ 19	+ 1	+ 25	0				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
27 h 0	179 18.6	+23 21.0
1	194 18.5	20.9
2	209 18.3	20.8
3	224 18.2	20.7
4	239 18.1	20.6
5	254 17.9	20.5
6	269 17.8	+23 20.5
7	284 17.7	20.4
8	299 17.6	20.3
9	314 17.4	20.2
10	329 17.3	20.1
11	344 17.2	20.0
12	359 17.0	+23 19.9
13	14 16.9	19.8
14	29 16.8	19.7
15	44 16.7	19.6
16	59 16.5	19.5
17	74 16.4	19.4
18	89 16.3	+23 19.3
19	104 16.1	19.2
20	119 16.0	19.1
21	134 15.9	18.9
22	149 15.8	18.8
23	164 15.6	18.7
28 h 0	179 15.5	+23 18.6
1	194 15.4	18.5
2	209 15.2	18.4
3	224 15.1	18.3
4	239 15.0	18.2
5	254 14.9	18.1
6	269 14.7	+23 18.0
7	284 14.6	17.9
8	299 14.5	17.7
9	314 14.4	17.6
10	329 14.2	17.5
11	344 14.1	17.4
12	359 14.0	+23 17.3
13	14 13.8	17.2
14	29 13.7	17.0
15	44 13.6	16.9
16	59 13.5	16.8
17	74 13.3	16.7
18	89 13.2	+23 16.6
19	104 13.1	16.5
20	119 13.0	16.3
21	134 12.8	16.2
22	149 12.7	16.1
23	164 12.6	16.0
29 h 0	179 12.5	+23 15.8
1	194 12.3	15.7
2	209 12.2	15.6
3	224 12.1	15.5
4	239 11.9	15.3
5	254 11.8	15.2
6	269 11.7	+23 15.1
7	284 11.6	14.9
8	299 11.4	14.8
9	314 11.3	14.7
10	329 11.2	14.6
11	344 11.1	14.4
12	359 10.9	+23 14.3
13	14 10.8	14.2
14	29 10.7	14.0
15	44 10.6	13.9
16	59 10.4	13.7
17	74 10.3	13.6
18	89 10.2	+23 13.5
19	104 10.1	13.3
20	119 09.9	13.2
21	134 09.8	13.1
22	149 09.7	12.9
23	164 09.6	12.8
24	179 09.4	+23 12.6
code	−	− 1

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.6	−40 29.1
5	Achernar	336 00.2	−57 27.9
30	Acrux	173 59.9	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.8	+56 12.9
34	Alkaid	153 33.9	+49 32.8
55	Al Na'ir	28 39.7	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.1	+28 50.0
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	353 59.9	−42 33.2
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 02.9	−68 57.0
22	Avior	234 37.2	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.6
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.4	+45 57.2
53	Deneb	50 01.8	+45 06.7
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 41.0	−18 14.3
27	Dubhe	194 46.8	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.1	+ 9 39.7
56	Fomalhaut	16 13.3	−29 51.9
31	Gacrux	172 51.3	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.7	−60 09.4
6	Hamal	328 51.8	+23 14.6
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 16.8	+74 20.9
57	Markab	14 23.1	+14 57.3
8	Menkar	315 02.3	+ 3 54.6
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.3	−69 31.7
9	Mirfak	309 45.3	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.3	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.1	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.3
39	Zub'g'bl	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 27	28	29
h	m s	m s	m s
0	− 2 45.4	− 2 57.7	− 3 10.0
6	− 2 48.5	− 3 00.8	− 3 13.0
12	− 2 51.6	− 3 03.9	− 3 16.0
18	− 2 54.7	− 3 06.9	− 3 19.0
24	− 2 57.7	− 3 10.0	− 3 22.0

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 27 h m	28 h m	29 h m	30 h m
72	▭	▭	■	■	■	{0 27 / 23 34}
70	▭	▭	■	■	{1 32 / 23 55}	23 20
68	▭	▭	■	■	{0 10 / 23 30}	23 08
66	▭	▭	■	{0 31 / 23 51}	23 12	22 58
64	1 36	////	23 15	23 04	22 56	22 50
62	2 13	////	22 38	22 43	22 43	22 43
60	2 39	////	22 12	22 25	22 32	22 37
58	2 59	////	21 51	22 11	22 23	22 31
56	3 16	////	21 34	21 58	22 15	22 26
54	3 30	////	21 19	21 47	22 07	22 22
52	3 42	////	21 07	21 37	22 00	22 18
50	3 53	////	20 55	21 29	21 54	22 14
45	4 15	1 43	20 32	21 10	21 41	22 07
40	4 33	2 30	20 13	20 55	21 30	22 00
35	4 48	3 01	19 57	20 42	21 20	21 54
30	5 01	3 25	19 43	20 30	21 12	21 49
20	5 23	3 59	19 19	20 11	20 58	21 40
10	5 42	4 24	18 59	19 54	20 45	21 32
0	6 00	4 44	18 40	19 38	20 33	21 25
10	6 17	5 02	18 21	19 22	20 21	21 18
20	6 35	5 16	18 00	19 05	20 08	21 10
30	6 56	5 31	17 36	18 45	19 54	21 01
35	7 08	5 38	17 22	18 33	19 45	20 56
40	7 22	5 45	17 06	18 20	19 35	20 50
45	7 39	5 52	16 47	18 04	19 24	20 43
50	8 00	6 01	16 22	17 44	19 10	20 34
52	8 10	6 04	16 10	17 35	19 03	20 30
54	8 21	6 08	15 57	17 24	18 56	20 26
56	8 33	6 12	15 41	17 12	18 47	20 21
58	8 48	6 15	15 23	16 59	18 38	20 16
60 S	9 05	6 20	15 00	16 42	18 27	20 10

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 27 h m	28 h m	29 h m	30 h m
72	▭	▭	■	■	■	5 31
70	▭	▭	■	■	2 29	6 01
68	▭	▭	■	■	3 51	6 24
66	▭	▭	■	1 29	4 28	6 41
64	22 29	////	■	2 44	4 54	6 55
62	21 53	////	1 30	3 20	5 15	7 06
60	21 27	////	2 08	3 46	5 31	7 16
58	21 07	////	2 35	4 06	5 45	7 24
56	20 50	////	2 56	4 23	5 57	7 32
54	20 36	////	3 14	4 37	6 07	7 39
52	20 24	////	3 29	4 49	6 16	7 44
50	20 13	////	3 42	5 00	6 24	7 50
45	19 51	22 23	4 08	5 22	6 41	8 01
40	19 33	21 36	4 29	5 41	6 55	8 11
35	19 18	21 05	4 47	5 56	7 07	8 19
30	19 05	20 41	5 02	6 09	7 18	8 26
20	18 43	20 07	5 27	6 31	7 35	8 38
10	18 24	19 42	5 49	6 50	7 50	8 48
0	18 07	19 22	6 09	7 08	8 04	8 58
10	17 50	19 05	6 29	7 26	8 18	9 08
20	17 31	18 50	6 51	7 44	8 33	9 18
30	17 10	18 35	7 16	8 06	8 50	9 29
35	16 58	18 29	7 30	8 18	9 00	9 36
40	16 43	18 21	7 47	8 33	9 11	9 44
45	16 27	18 14	8 07	8 50	9 24	9 52
50	16 06	18 05	8 32	9 11	9 40	10 03
52	15 57	18 03	8 44	9 21	9 47	10 07
54	15 46	17 59	8 58	9 32	9 55	10 13
56	15 33	17 55	9 14	9 44	10 04	10 18
58	15 18	17 50	9 33	9 59	10 14	10 25
60 S	15 01	17 46	9 56	10 16	10 26	10 32

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
27	24 54	8 52	12 18	10 19	18 58
28	0 54	8 52	12 17	10 16	18 54
29	1 51	8 52	12 16	10 13	18 50
30	2 46	8 52	12 15	10 10	18 46

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	27	28	29
°	′	′	′
0	17.7	18.3	18.7
4	17.7	18.3	18.7
8	17.7	18.3	18.7
12	17.7	18.3	18.7
16	17.6	18.2	18.6
20	17.6	18.2	18.6
24	17.5	18.1	18.5
28	17.5	18.1	18.4
32	17.4	18.0	18.3
36	17.4	17.9	18.2
40	17.3	17.8	18.1
44	17.2	17.7	18.0
48	17.1	17.6	17.8
52	17.0	17.4	17.7
56	16.9	17.3	17.6
60	16.8	17.2	17.4
64	16.7	17.0	17.2
68	16.6	16.9	17.1
72	16.5	16.8	16.9
76	16.4	16.6	16.8
80	16.3	16.5	16.6
84	16.1	16.3	16.4
88	16.0	16.2	16.3
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	27	28	29
°	′	′	′
0	14.3	14.0	13.7
4	14.3	14.0	13.7
8	14.3	14.0	13.8
12	14.4	14.0	13.8
16	14.4	14.1	13.9
20	14.4	14.1	13.9
24	14.5	14.2	14.0
28	14.5	14.2	14.1
32	14.6	14.3	14.2
36	14.7	14.4	14.3
40	14.8	14.5	14.4
44	14.8	14.6	14.5
48	14.9	14.7	14.6
52	15.0	14.9	14.8
56	15.1	15.0	14.9
60	15.2	15.1	15.1
64	15.3	15.3	15.2
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.8	15.8	15.9
84	15.9	16.0	16.1
88	16.0	16.1	16.2
90			

Subtract from table, back cover

Full Moon 27

GMT	♈ GHA	VENUS −3.9 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
30 h 0	277 45.9	226 57.7	+15 26.3	176 14.2	+23 55.8	207 18.3	+21 37.1	77 47.2	− 5 40.3	320 04.8	90	−15 07.0	+136
1	292 48.4	241 57.7	26.9	191 14.9	55.7	222 20.1	37.2	92 49.7	40.3	334 32.8	91	14 53.4	+138
2	307 50.8	256 57.6	27.6	206 15.5	55.6	237 22.0	37.2	107 52.1	40.3	349 00.9	92	14 39.6	+138
3	322 53.3	271 57.6	•• 28.2	221 16.2	•• 55.5	252 23.9	•• 37.3	122 54.6	•• 40.3	3 29.1	92	•14 25.8	+139
4	337 55.8	286 57.5	28.9	236 16.9	55.3	267 25.7	37.4	137 57.0	40.4	17 57.3	92	14 11.9	+140
5	352 58.2	301 57.5	29.5	251 17.5	55.2	282 27.6	37.5	152 59.4	40.4	32 25.5	94	13 57.9	+141
6	8 00.7	316 57.4	+15 30.1	266 18.2	+23 55.1	297 29.5	+21 37.5	168 01.9	− 5 40.4	46 53.9	94	−13 43.8	+142
7	23 03.2	331 57.4	30.7	281 18.8	55.0	312 31.4	37.6	183 04.3	40.4	61 22.3	95	13 29.6	+142
8	38 05.6	346 57.3	31.4	296 19.5	54.9	327 33.2	37.7	198 06.8	40.4	75 50.8	95	13 15.4	+143
9	53 08.1	1 57.3	•• 32.0	311 20.2	•• 54.8	342 35.1	•• 37.8	213 09.2	•• 40.5	90 19.3	96	•13 01.1	+144
10	68 10.6	16 57.2	32.6	326 20.8	54.6	357 37.0	37.8	228 11.7	40.5	104 47.9	97	12 46.7	+145
11	83 13.0	31 57.2	33.3	341 21.5	54.5	12 38.9	37.9	243 14.1	40.5	119 16.6	97	12 32.2	+145
12	98 15.5	46 57.1	+15 33.9	356 22.2	+23 54.4	27 40.7	+21 38.0	258 16.5	− 5 40.5	133 45.3	98	−12 17.7	+146
13	113 17.9	61 57.1	34.5	11 22.8	54.3	42 42.6	38.1	273 19.0	40.6	148 14.1	98	12 03.1	+147
14	128 20.4	76 57.0	35.2	26 23.5	54.1	57 44.5	38.1	288 21.4	40.6	162 42.9	99	11 48.4	+147
15	143 22.9	91 56.9	•• 35.8	41 24.2	•• 54.0	72 46.4	•• 38.2	303 23.9	•• 40.6	177 11.8	100	•11 33.7	+148
16	158 25.3	106 56.9	36.4	56 24.8	53.9	87 48.2	38.3	318 26.3	40.6	191 40.8	100	11 18.9	+148
17	173 27.8	121 56.8	37.1	71 25.5	53.8	102 50.1	38.4	333 28.7	40.6	206 09.8	101	11 04.1	+150
18	188 30.3	136 56.8	+15 37.7	86 26.2	+23 53.7	117 52.0	+21 38.4	348 31.2	− 5 40.7	220 38.9	101	−10 49.1	+150
19	203 32.7	151 56.7	38.3	101 26.8	53.5	132 53.9	38.5	3 33.6	40.7	235 08.0	102	10 34.1	+150
20	218 35.2	166 56.6	39.0	116 27.5	53.4	147 55.8	38.6	18 36.1	40.7	249 37.2	102	10 19.1	+151
21	233 37.7	181 56.6	•• 39.6	131 28.2	•• 53.3	162 57.6	•• 38.7	33 38.5	•• 40.7	264 06.4	103	•10 04.0	+151
22	248 40.1	196 56.5	40.2	146 28.8	53.2	177 59.5	38.7	48 41.0	40.7	278 35.7	104	9 48.9	+152
23	263 42.6	211 56.5	40.8	161 29.5	53.0	193 01.4	38.8	63 43.4	40.8	293 05.1	104	9 33.7	+153
1 0	278 45.1	226 56.4	+15 41.5	176 30.2	+23 52.9	208 03.3	+21 38.9	78 45.8	− 5 40.8	307 34.5	104	− 9 18.4	+153
1	293 47.5	241 56.3	42.1	191 30.8	52.8	223 05.1	39.0	93 48.3	40.8	322 03.9	105	9 03.1	+154
2	308 50.0	256 56.3	42.7	206 31.5	52.7	238 07.0	39.0	108 50.7	40.8	336 33.4	106	8 47.7	+154
3	323 52.4	271 56.2	•• 43.4	221 32.1	•• 52.5	253 08.9	•• 39.1	123 53.2	•• 40.8	351 03.0	106	• 8 32.3	+154
4	338 54.9	286 56.1	44.0	236 32.8	52.4	268 10.8	39.2	138 55.6	40.9	5 32.6	106	8 16.9	+155
5	353 57.4	301 56.1	44.6	251 33.5	52.3	283 12.6	39.3	153 58.0	40.9	20 02.2	107	8 01.4	+155
6	8 59.8	316 56.0	+15 45.3	266 34.1	+23 52.2	298 14.5	+21 39.3	169 00.5	− 5 40.9	34 31.9	107	− 7 45.9	+156
7	24 02.3	331 55.9	45.9	281 34.8	52.0	313 16.4	39.4	184 02.9	40.9	49 01.6	108	7 30.3	+156
8	39 04.8	346 55.9	46.5	296 35.5	51.9	328 18.3	39.5	199 05.4	41.0	63 31.4	108	7 14.7	+156
9	54 07.2	1 55.8	•• 47.1	311 36.1	•• 51.8	343 20.1	•• 39.6	214 07.8	•• 41.0	78 01.2	109	• 6 59.1	+157
10	69 09.7	16 55.7	47.8	326 36.8	51.6	358 22.0	39.6	229 10.2	41.0	92 31.1	109	6 43.4	+157
11	84 12.2	31 55.6	48.4	341 37.5	51.5	13 23.9	39.7	244 12.7	41.0	107 01.0	109	6 27.7	+158
12	99 14.6	46 55.6	+15 49.0	356 38.1	+23 51.4	28 25.8	+21 39.8	259 15.1	− 5 41.0	121 30.9	110	− 6 11.9	+158
13	114 17.1	61 55.5	49.6	11 38.8	51.3	43 27.7	39.9	274 17.5	41.1	136 00.9	110	5 56.1	+158
14	129 19.6	76 55.4	50.3	26 39.5	51.1	58 29.5	39.9	289 20.0	41.1	150 30.9	110	5 40.3	+158
15	144 22.0	91 55.3	•• 50.9	41 40.2	•• 51.0	73 31.4	•• 40.0	304 22.4	•• 41.1	165 00.9	111	• 5 24.5	+159
16	159 24.5	106 55.3	51.5	56 40.8	50.9	88 33.3	40.1	319 24.9	41.1	179 31.0	111	5 08.6	+158
17	174 26.9	121 55.2	52.1	71 41.5	50.7	103 35.2	40.1	334 27.3	41.2	194 01.1	112	4 52.8	+159
18	189 29.4	136 55.1	+15 52.8	86 42.2	+23 50.6	118 37.0	+21 40.2	349 29.7	− 5 41.2	208 31.3	111	− 4 36.9	+160
19	204 31.9	151 55.0	53.4	101 42.8	50.5	133 38.9	40.3	4 32.2	41.2	223 01.4	112	4 20.9	+159
20	219 34.3	166 55.0	54.0	116 43.5	50.3	148 40.8	40.4	19 34.6	41.2	237 31.6	113	4 05.0	+160
21	234 36.8	181 54.9	•• 54.6	131 44.2	•• 50.2	163 42.7	•• 40.4	34 37.0	•• 41.2	252 01.9	112	• 3 49.0	+160
22	249 39.3	196 54.8	55.3	146 44.8	50.1	178 44.5	40.5	49 39.5	41.3	266 32.1	113	3 33.0	+160
23	264 41.7	211 54.7	55.9	161 45.5	49.9	193 46.4	40.6	64 41.9	41.3	281 02.4	113	3 17.0	+160
2 0	279 44.2	226 54.6	+15 56.5	176 46.2	+23 49.8	208 48.3	+21 40.7	79 44.4	− 5 41.3	295 32.7	114	− 3 01.0	+160
1	294 46.7	241 54.5	57.1	191 46.8	49.7	223 50.2	40.7	94 46.8	41.3	310 03.1	113	2 45.0	+160
2	309 49.1	256 54.5	57.8	206 47.5	49.5	238 52.1	40.8	109 49.2	41.4	324 33.4	114	2 29.0	+161
3	324 51.6	271 54.4	•• 58.4	221 48.2	•• 49.4	253 53.9	•• 40.9	124 51.7	•• 41.4	339 03.8	114	• 2 12.9	+160
4	339 54.0	286 54.3	59.0	236 48.8	49.3	268 55.8	41.0	139 54.1	41.4	353 34.2	114	1 56.9	+161
5	354 56.5	301 54.2	15 59.6	251 49.5	49.1	283 57.7	41.0	154 56.5	41.4	8 04.6	115	1 40.8	+160
6	9 59.0	316 54.1	+16 00.3	266 50.2	+23 49.0	298 59.6	+21 41.1	169 59.0	− 5 41.5	22 35.1	114	− 1 24.8	+161
7	25 01.4	331 54.0	00.9	281 50.8	48.9	314 01.4	41.2	185 01.4	41.5	37 05.5	115	1 08.7	+161
8	40 03.9	346 53.9	01.5	296 51.5	48.7	329 03.3	41.2	200 03.8	41.5	51 36.0	114	0 52.6	+160
9	55 06.4	1 53.8	•• 02.1	311 52.2	•• 48.6	344 05.2	•• 41.3	215 06.3	•• 41.5	66 06.4	115	• 0 36.6	+161
10	70 08.8	16 53.8	02.7	326 52.9	48.5	359 07.1	41.4	230 08.7	41.5	80 36.9	115	0 20.5	+160
11	85 11.3	31 53.7	03.4	341 53.5	48.3	14 09.0	41.5	245 11.1	41.6	95 07.4	116	− 0 04.5	+161
12	100 13.8	46 53.6	+16 04.0	356 54.2	+23 48.2	29 10.8	+21 41.5	260 13.6	− 5 41.6	109 38.0	115	+ 0 11.6	+160
13	115 16.2	61 53.5	04.6	11 54.9	48.1	44 12.7	41.6	275 16.0	41.6	124 08.5	115	0 27.6	+161
14	130 18.7	76 53.4	05.2	26 55.5	47.9	59 14.6	41.7	290 18.5	41.6	138 39.0	115	0 43.7	+160
15	145 21.2	91 53.3	•• 05.8	41 56.2	•• 47.8	74 16.5	•• 41.8	305 20.9	•• 41.7	153 09.5	116	• 0 59.7	+160
16	160 23.6	106 53.2	06.5	56 56.9	47.6	89 18.4	41.8	320 23.3	41.7	167 40.1	115	1 15.7	+160
17	175 26.1	121 53.1	07.1	71 57.5	47.5	104 20.2	41.9	335 25.8	41.7	182 10.6	116	1 31.7	+160
18	190 28.5	136 53.0	+16 07.7	86 58.2	+23 47.4	119 22.1	+21 42.0	350 28.2	− 5 41.7	196 41.2	115	+ 1 47.7	+160
19	205 31.0	151 52.9	08.3	101 58.9	47.2	134 24.0	42.0	5 30.6	41.8	211 11.7	116	2 03.7	+160
20	220 33.5	166 52.8	08.9	116 59.6	47.1	149 25.9	42.1	20 33.1	41.8	225 42.3	115	2 19.7	+159
21	235 35.9	181 52.7	•• 09.6	132 00.2	•• 46.9	164 27.8	•• 42.2	35 35.5	•• 41.8	240 12.8	116	• 2 35.6	+160
22	250 38.4	196 52.6	10.2	147 00.9	46.8	179 29.6	42.3	50 37.9	41.8	254 43.4	115	2 51.6	+159
23	265 40.9	211 52.5	10.8	162 01.6	46.7	194 31.5	42.3	65 40.4	41.9	269 13.9	116	3 07.5	+159
24	280 43.3	226 52.4	+16 11.4	177 02.2	+23 46.5	209 33.4	+21 42.4	80 42.8	− 5 41.9	283 44.5	115	+ 3 23.4	+158
code	—	− 1	+ 6	+ 7	− 1	+ 19	+ 1	+ 24	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
30	0	179 09.4	+23 12.6
	1	194 09.3	12.5
	2	209 09.2	12.4
	3	224 09.1	12.2
	4	239 09.0	12.1
	5	254 08.8	11.9
	6	269 08.7	+23 11.8
	7	284 08.6	11.6
	8	299 08.5	11.5
	9	314 08.3	11.3
	10	329 08.2	11.2
	11	344 08.1	11.0
	12	359 08.0	+23 10.9
	13	14 07.8	10.7
	14	29 07.7	10.6
	15	44 07.6	10.4
	16	59 07.5	10.3
	17	74 07.4	10.1
	18	89 07.2	+23 10.0
	19	104 07.1	09.8
	20	119 07.0	09.7
	21	134 06.9	09.5
	22	149 06.7	09.3
	23	164 06.6	09.2
1	0	179 06.5	+23 09.0
	1	194 06.4	08.9
	2	209 06.3	08.7
	3	224 06.1	08.6
	4	239 06.0	08.4
	5	254 05.9	08.2
	6	269 05.8	+23 08.1
	7	284 05.6	07.9
	8	299 05.5	07.7
	9	314 05.4	07.6
	10	329 05.3	07.4
	11	344 05.2	07.2
	12	359 05.0	+23 07.1
	13	14 04.9	06.9
	14	29 04.8	06.7
	15	44 04.7	06.6
	16	59 04.6	06.4
	17	74 04.4	06.2
	18	89 04.3	+23 06.1
	19	104 04.2	05.9
	20	119 04.1	05.7
	21	134 04.0	05.5
	22	149 03.8	05.4
	23	164 03.7	05.2
2	0	179 03.6	+23 05.0
	1	194 03.5	04.8
	2	209 03.4	04.7
	3	224 03.2	04.5
	4	239 03.1	04.3
	5	254 03.0	04.1
	6	269 02.9	+23 04.0
	7	284 02.8	03.8
	8	299 02.7	03.6
	9	314 02.5	03.4
	10	329 02.4	03.2
	11	344 02.3	03.0
	12	359 02.2	+23 02.9
	13	14 02.1	02.7
	14	29 01.9	02.5
	15	44 01.8	02.3
	16	59 01.7	02.1
	17	74 01.6	01.9
	18	89 01.5	+23 01.7
	19	104 01.4	01.6
	20	119 01.2	01.4
	21	134 01.1	01.2
	22	149 01.0	01.0
	23	164 00.9	00.8
	24	179 00.8	+23 00.6
code		—	− 2

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.6	−40 29.1
5	Achernar	336 00.1	−57 27.9
30	Acrux	173 59.9	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.8	+56 12.9
34	Alkaid	153 34.0	+49 32.8
55	Al Na'ir	28 39.7	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.1	+28 50.0
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	353 59.8	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.5	+19 25.4
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.7
13	Bellatrix	279 20.6	+ 6 18.7
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.4	+45 57.2
53	Deneb	50 01.8	+45 06.7
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.9	−18 14.3
27	Dubhe	194 46.8	+62 00.4
14	Elnath	279 09.9	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.0	+ 9 39.7
56	Fomalhaut	16 13.3	−29 51.9
31	Gacrux	172 51.3	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.7	−60 09.4
6	Hamal	328 51.7	+23 14.6
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 16.9	+74 20.9
57	Markab	14 23.0	+14 57.3
8	Menkar	315 02.3	+ 3 54.6
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.4	−69 31.7
9	Mirfak	309 45.2	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.3	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.1	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.3
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 30 m s	1 m s	2 m s
h			
0	− 3 22.0	− 3 33.8	− 3 45.4
6	− 3 24.9	− 3 36.7	− 3 48.2
12	− 3 27.9	− 3 39.6	− 3 51.1
18	− 3 30.8	− 3 42.5	− 3 53.9
24	− 3 33.8	− 3 45.4	− 3 56.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 30 h m	1 h m	2 h m	3 h m
72	▭	▭	{0 27 / 23 34}	22 59	22 27	21 53
70	▭	▭	23 20	22 54	22 31	22 06
68	▭	▭	23 08	22 50	22 34	22 17
66	0 14	////	22 58	22 47	22 37	22 26
64	1 40	////	22 50	22 44	22 39	22 33
62	2 16	////	22 43	22 42	22 41	22 40
60	2 42	////	22 37	22 40	22 43	22 46
58	3 02	////	22 31	22 38	22 44	22 51
56	3 18	////	22 26	22 36	22 46	22 55
54	3 32	////	22 22	22 35	22 47	22 59
52	3 44	////	22 18	22 34	22 48	23 03
50	3 55	////	22 14	22 32	22 49	23 06
45	4 17	1 45	22 07	22 30	22 51	23 14
40	4 35	2 32	22 00	22 27	22 53	23 20
35	4 49	3 03	21 54	22 25	22 55	23 25
30	5 02	3 26	21 49	22 23	22 57	23 30
20	5 24	4 00	21 40	22 20	22 59	23 38
10	5 43	4 25	21 32	22 18	23 02	23 46
0	6 00	4 45	21 25	22 15	23 04	23 53
10	6 17	5 02	21 18	22 12	23 06	24 00
20	6 35	5 16	21 10	22 10	23 09	24 07
30	6 56	5 31	21 01	22 07	23 12	24 16
35	7 09	5 38	20 56	22 05	23 13	24 21
40	7 23	5 46	20 50	22 03	23 15	24 27
45	7 39	5 52	20 43	22 01	23 17	24 34
50	7 59	6 01	20 34	21 58	23 20	24 42
52	8 09	6 03	20 30	21 56	23 21	24 46
54	8 20	6 07	20 26	21 55	23 23	24 50
56	8 32	6 11	20 21	21 54	23 24	24 55
58	8 47	6 15	20 16	21 52	23 26	25 00
60	9 04	6 19	20 10	21 50	23 28	25 06

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 30 h m	1 h m	2 h m	3 h m
72	▭	▭	5 31	8 13	10 34	12 54
70	▭	▭	6 01	8 24	10 35	12 44
68	▭	▭	6 24	8 33	10 35	12 36
66	23 43	////	6 41	8 41	10 36	12 29
64	22 26	////	6 55	8 47	10 36	12 23
62	21 50	////	7 06	8 53	10 36	12 18
60	21 25	////	7 16	8 57	10 36	12 14
58	21 05	////	7 24	9 01	10 36	12 10
56	20 49	////	7 32	9 05	10 37	12 07
54	20 35	////	7 39	9 08	10 37	12 04
52	20 23	////	7 44	9 11	10 37	12 01
50	20 13	////	7 50	9 14	10 37	11 59
45	19 50	22 21	8 01	9 20	10 37	11 54
40	19 33	21 35	8 11	9 25	10 37	11 49
35	19 18	21 04	8 19	9 29	10 38	11 46
30	19 05	20 41	8 26	9 32	10 38	11 42
20	18 43	20 07	8 38	9 39	10 38	11 37
10	18 25	19 43	8 48	9 44	10 38	11 32
0	18 07	19 22	8 58	9 49	10 38	11 27
10	17 50	19 05	9 08	9 54	10 38	11 22
20	17 32	18 51	9 18	9 59	10 38	11 17
30	17 11	18 36	9 29	10 05	10 39	11 12
35	16 59	18 30	9 36	10 08	10 39	11 08
40	16 45	18 22	9 44	10 12	10 39	11 05
45	16 28	18 14	9 52	10 16	10 39	11 01
50	16 08	18 07	10 03	10 22	10 39	10 56
52	15 58	18 03	10 07	10 24	10 39	10 53
54	15 47	18 00	10 13	10 26	10 39	10 51
56	15 35	17 56	10 18	10 29	10 39	10 48
58	15 21	17 53	10 25	10 32	10 39	10 45
60	15 04	17 49	10 32	10 36	10 39	10 41

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
30	2 46	8 52	12 15	10 10	18 46
1	3 37	8 52	12 14	10 07	18 42
2	4 27	8 52	12 12	10 04	18 38
3	5 15	8 53	12 11	10 01	18 34

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.2	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	30 ′	1 ′	2 ′
0	19.0	19.0	18.7
4	19.0	19.0	18.7
8	18.9	18.9	18.7
12	18.9	18.9	18.7
16	18.9	18.9	18.6
20	18.8	18.8	18.6
24	18.7	18.7	18.5
28	18.6	18.6	18.4
32	18.5	18.5	18.3
36	18.4	18.4	18.2
40	18.3	18.3	18.1
44	18.2	18.2	18.0
48	18.0	18.0	17.8
52	17.9	17.9	17.7
56	17.7	17.7	17.6
60	17.6	17.6	17.4
64	17.4	17.4	17.2
68	17.2	17.2	17.1
72	17.0	17.0	16.9
76	16.8	16.8	16.8
80	16.7	16.7	16.6
84	16.5	16.5	16.4
88	16.3	16.3	16.3
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	30 ′	1 ′	2 ′
0	13.6	13.6	13.7
4	13.6	13.6	13.7
8	13.6	13.6	13.8
12	13.7	13.7	13.8
16	13.7	13.7	13.9
20	13.8	13.8	13.9
24	13.9	13.9	14.0
28	13.9	13.9	14.1
32	14.0	14.0	14.2
36	14.2	14.2	14.3
40	14.3	14.3	14.4
44	14.4	14.4	14.5
48	14.5	14.5	14.6
52	14.7	14.7	14.8
56	14.9	14.9	14.9
60	15.0	15.0	15.1
64	15.2	15.2	15.2
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.9	15.9	15.9
84	16.1	16.1	16.1
88	16.2	16.2	16.2
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.8 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
3 0	280 43.3	226 52.4	+16 11.4	177 02.2	+23 46.5	209 33.4	+21 42.4	80 42.8	− 5 41.9	283 44.5	115	+ 3 23.4	+158
1	295 45.8	241 52.3	12.0	192 02.9	46.4	224 35.3	42.5	95 45.2	41.9	298 15.0	115	3 39.2	+159
2	310 48.3	256 52.2	12.6	207 03.6	46.2	239 37.2	42.6	110 47.7	41.9	312 45.5	115	3 55.1	+158
3	325 50.7	271 52.1	·· 13.3	222 04.3	·· 46.1	254 39.0	·· 42.6	125 50.1	·· 42.0	327 16.0	116	· 4 10.9	+158
4	340 53.2	286 52.0	13.9	237 04.9	46.0	269 40.9	42.7	140 52.5	42.0	341 46.6	115	4 26.7	+157
5	355 55.7	301 51.9	14.5	252 05.6	45.8	284 42.8	42.8	155 54.9	42.0	356 17.1	114	4 42.4	+158
6	10 58.1	316 51.8	+16 15.1	267 06.3	+23 45.7	299 44.7	+21 42.8	170 57.4	− 5 42.0	10 47.5	115	+ 4 58.2	+156
7	26 00.6	331 51.7	15.7	282 06.9	45.5	314 46.6	42.9	185 59.8	42.1	25 18.0	115	5 13.8	+157
8	41 03.0	346 51.6	16.3	297 07.6	45.4	329 48.4	43.0	201 02.2	42.1	39 48.5	114	5 29.5	+156
9	56 05.5	1 51.5	·· 17.0	312 08.3	·· 45.2	344 50.3	·· 43.1	216 04.7	·· 42.1	54 18.9	115	· 5 45.1	+156
10	71 08.0	16 51.3	17.6	327 09.0	45.1	359 52.2	43.1	231 07.1	42.1	68 49.4	114	6 00.7	+156
11	86 10.4	31 51.2	18.2	342 09.6	44.9	14 54.1	43.2	246 09.5	42.2	83 19.8	114	6 16.3	+155
12	101 12.9	46 51.1	+16 18.8	357 10.3	+23 44.8	29 56.0	+21 43.3	261 12.0	− 5 42.2	97 50.2	113	+ 6 31.8	+155
13	116 15.4	61 51.0	19.4	12 11.0	44.7	44 57.8	43.3	276 14.4	42.2	112 20.5	114	6 47.3	+154
14	131 17.8	76 50.9	20.0	27 11.7	44.5	59 59.7	43.4	291 16.8	42.2	126 50.9	113	7 02.7	+154
15	146 20.3	91 50.8	·· 20.6	42 12.3	·· 44.4	75 01.6	·· 43.5	306 19.3	·· 42.3	141 21.2	113	· 7 18.1	+153
16	161 22.8	106 50.7	21.3	57 13.0	44.2	90 03.5	43.6	321 21.7	42.3	155 51.5	113	7 33.4	+153
17	176 25.2	121 50.6	21.9	72 13.7	44.1	105 05.4	43.6	336 24.1	42.3	170 21.8	113	7 48.7	+153
18	191 27.7	136 50.4	+16 22.5	87 14.3	+23 43.9	120 07.2	+21 43.7	351 26.5	− 5 42.3	184 52.1	112	+ 8 04.0	+152
19	206 30.1	151 50.3	23.1	102 15.0	43.8	135 09.1	43.8	6 29.0	42.4	199 22.3	112	8 19.2	+151
20	221 32.6	166 50.2	23.7	117 15.7	43.6	150 11.0	43.8	21 31.4	42.4	213 52.5	112	8 34.3	+152
21	236 35.1	181 50.1	·· 24.3	132 16.4	·· 43.5	165 12.9	·· 43.9	36 33.8	·· 42.4	228 22.7	111	· 8 49.5	+150
22	251 37.5	196 50.0	24.9	147 17.0	43.3	180 14.8	44.0	51 36.3	42.4	242 52.8	111	9 04.5	+150
23	266 40.0	211 49.9	25.5	162 17.7	43.2	195 16.6	44.1	66 38.7	42.5	257 22.9	111	9 19.5	+149
4 0	281 42.5	226 49.7	+16 26.2	177 18.4	+23 43.0	210 18.5	+21 44.1	81 41.1	− 5 42.5	271 53.0	111	+ 9 34.4	+149
1	296 44.9	241 49.6	26.8	192 19.1	42.9	225 20.4	44.2	96 43.6	42.5	286 23.1	110	9 49.3	+148
2	311 47.4	256 49.5	27.4	207 19.7	42.7	240 22.3	44.3	111 46.0	42.5	300 53.1	109	10 04.1	+148
3	326 49.9	271 49.4	·· 28.0	222 20.4	·· 42.6	255 24.2	·· 44.3	126 48.4	·· 42.6	315 23.0	110	·10 18.9	+147
4	341 52.3	286 49.2	28.6	237 21.1	42.4	270 26.0	44.4	141 50.8	42.6	329 53.0	109	10 33.6	+147
5	356 54.8	301 49.1	29.2	252 21.8	42.3	285 27.9	44.5	156 53.3	42.6	344 22.9	109	10 48.3	+145
6	11 57.3	316 49.0	+16 29.8	267 22.4	+23 42.1	300 29.8	+21 44.6	171 55.7	− 5 42.6	358 52.8	108	+11 02.8	+146
7	26 59.7	331 48.9	30.4	282 23.1	42.0	315 31.7	44.6	186 58.1	42.7	13 22.6	108	11 17.4	+144
8	42 02.2	346 48.7	31.0	297 23.8	41.8	330 33.6	44.7	202 00.6	42.7	27 52.4	107	11 31.8	+144
9	57 04.6	1 48.6	·· 31.6	312 24.5	·· 41.7	345 35.5	·· 44.8	217 03.0	·· 42.7	42 22.1	107	·11 46.2	+143
10	72 07.1	16 48.5	32.2	327 25.1	41.5	0 37.3	44.8	232 05.4	42.8	56 51.8	107	12 00.5	+142
11	87 09.6	31 48.4	32.9	342 25.8	41.4	15 39.2	44.9	247 07.8	42.8	71 21.5	106	12 14.7	+142
12	102 12.0	46 48.2	+16 33.5	357 26.5	+23 41.2	30 41.1	+21 45.0	262 10.3	− 5 42.8	85 51.1	106	+12 28.9	+141
13	117 14.5	61 48.1	34.1	12 27.2	41.1	45 43.0	45.0	277 12.7	42.8	100 20.7	105	12 43.0	+140
14	132 17.0	76 48.0	34.7	27 27.8	40.9	60 44.9	45.1	292 15.1	42.9	114 50.2	105	12 57.0	+140
15	147 19.4	91 47.8	·· 35.3	42 28.5	·· 40.8	75 46.8	·· 45.2	307 17.5	·· 42.9	129 19.7	105	·13 11.0	+138
16	162 21.9	106 47.7	35.9	57 29.2	40.6	90 48.6	45.3	322 20.0	42.9	143 49.2	104	13 24.8	+138
17	177 24.4	121 47.6	36.5	72 29.9	40.5	105 50.5	45.3	337 22.4	42.9	158 18.6	103	13 38.6	+137
18	192 26.8	136 47.4	+16 37.1	87 30.5	+23 40.3	120 52.4	+21 45.4	352 24.8	− 5 43.0	172 47.9	103	+13 52.3	+137
19	207 29.3	151 47.3	37.7	102 31.2	40.1	135 54.3	45.5	7 27.2	43.0	187 17.2	103	14 06.0	+135
20	222 31.8	166 47.2	38.3	117 31.9	40.0	150 56.2	45.5	22 29.7	43.0	201 46.5	102	14 19.5	+135
21	237 34.2	181 47.0	·· 38.9	132 32.6	·· 39.8	165 58.1	·· 45.6	37 32.1	·· 43.0	216 15.7	101	·14 33.0	+134
22	252 36.7	196 46.9	39.5	147 33.3	39.7	180 59.9	45.7	52 34.5	43.1	230 44.8	101	14 46.4	+133
23	267 39.1	211 46.8	40.1	162 33.9	39.5	196 01.8	45.7	67 36.9	43.1	245 13.9	100	14 59.7	+132
5 0	282 41.6	226 46.6	+16 40.7	177 34.6	+23 39.4	211 03.7	+21 45.8	82 39.4	− 5 43.1	259 42.9	100	+15 12.9	+131
1	297 44.1	241 46.5	41.3	192 35.3	39.2	226 05.6	45.9	97 41.8	43.2	274 11.9	100	15 26.0	+130
2	312 46.5	256 46.4	41.9	207 36.0	39.0	241 07.5	46.0	112 44.2	43.2	288 40.9	98	15 39.0	+129
3	327 49.0	271 46.2	·· 42.5	222 36.6	·· 38.9	256 09.4	·· 46.0	127 46.6	·· 43.2	303 09.7	99	·15 51.9	+129
4	342 51.5	286 46.1	43.1	237 37.3	38.7	271 11.2	46.1	142 49.1	43.2	317 38.6	97	16 04.8	+127
5	357 53.9	301 45.9	43.7	252 38.0	38.6	286 13.1	46.2	157 51.5	43.3	332 07.3	98	16 17.5	+127
6	12 56.4	316 45.8	+16 44.3	267 38.7	+23 38.4	301 15.0	+21 46.2	172 53.9	− 5 43.3	346 36.1	96	+16 30.2	+125
7	27 58.9	331 45.6	44.9	282 39.3	38.3	316 16.9	46.3	187 56.3	43.3	1 04.7	96	16 42.7	+125
8	43 01.3	346 45.5	45.5	297 40.0	38.1	331 18.8	46.4	202 58.8	43.4	15 33.3	96	16 55.2	+123
9	58 03.8	1 45.4	·· 46.1	312 40.7	·· 37.9	346 20.7	·· 46.4	218 01.2	·· 43.4	30 01.9	94	·17 07.5	+123
10	73 06.3	16 45.2	46.7	327 41.4	37.8	1 22.5	46.5	233 03.6	43.4	44 30.3	95	17 19.8	+122
11	88 08.7	31 45.1	47.3	342 42.1	37.6	16 24.4	46.6	248 06.0	43.4	58 58.8	94	17 32.0	+120
12	103 11.2	46 44.9	+16 47.9	357 42.7	+23 37.5	31 26.3	+21 46.7	263 08.5	− 5 43.5	73 27.2	93	+17 44.0	+119
13	118 13.6	61 44.8	48.5	12 43.4	37.3	46 28.2	46.7	278 10.9	43.5	87 55.5	92	17 55.9	+119
14	133 16.1	76 44.6	49.1	27 44.1	37.1	61 30.1	46.8	293 13.3	43.5	102 23.7	92	18 07.8	+117
15	148 18.6	91 44.5	·· 49.7	42 44.8	·· 37.0	76 32.0	·· 46.9	308 15.7	·· 43.6	116 51.9	92	·18 19.5	+116
16	163 21.0	106 44.3	50.3	57 45.5	36.8	91 33.8	46.9	323 18.2	43.6	131 20.1	90	18 31.1	+116
17	178 23.5	121 44.2	50.9	72 46.1	36.6	106 35.7	47.0	338 20.6	43.6	145 48.1	91	18 42.7	+114
18	193 26.0	136 44.0	+16 51.5	87 46.8	+23 36.5	121 37.6	+21 47.1	353 23.0	− 5 43.6	160 16.2	89	+18 54.1	+113
19	208 28.4	151 43.9	52.1	102 47.5	36.3	136 39.5	47.1	8 25.4	43.7	174 44.1	89	19 05.4	+111
20	223 30.9	166 43.7	52.7	117 48.2	36.2	151 41.4	47.2	23 27.8	43.7	189 12.0	89	19 16.5	+111
21	238 33.4	181 43.6	·· 53.3	132 48.9	·· 36.0	166 43.3	·· 47.3	38 30.3	·· 43.7	203 39.9	87	·19 27.6	+110
22	253 35.8	196 43.4	53.9	147 49.5	35.8	181 45.2	47.3	53 32.7	43.8	218 07.6	88	19 38.6	+108
23	268 38.3	211 43.2	54.5	162 50.2	35.7	196 47.0	47.4	68 35.1	43.8	232 35.4	86	19 49.4	+107
24	283 40.8	226 43.1	+16 55.1	177 50.9	+23 35.5	211 48.9	+21 47.5	83 37.5	− 5 43.8	247 03.0	86	+20 00.1	+106
code	−	− 1	+ 6	+ 7	− 1	+ 19	0	+ 24	0				

GMT	SUN GHA	SUN Dec.
3 h 0	179 00.8	+23 00.6
1	194 00.7	00.4
2	209 00.5	00.2
3	224 00.4	+23 00.0
4	239 00.3	22 59.8
5	254 00.2	59.6
6	269 00.1	+22 59.4
7	284 00.0	59.2
8	298 59.8	59.0
9	313 59.7	58.8
10	328 59.6	58.6
11	343 59.5	58.4
12	358 59.4	+22 58.2
13	13 59.3	58.0
14	28 59.1	57.8
15	43 59.0	57.6
16	58 58.9	57.4
17	73 58.8	57.2
18	88 58.7	+22 57.0
19	103 58.6	56.8
20	118 58.5	56.6
21	133 58.3	56.4
22	148 58.2	56.2
23	163 58.1	56.0
4 0	178 58.0	+22 55.8
1	193 57.9	55.6
2	208 57.8	55.4
3	223 57.7	55.2
4	238 57.5	54.9
5	253 57.4	54.7
6	268 57.3	+22 54.5
7	283 57.2	54.3
8	298 57.1	54.1
9	313 57.0	53.9
10	328 56.9	53.7
11	343 56.8	53.4
12	358 56.6	+22 53.2
13	13 56.5	53.0
14	28 56.4	52.8
15	43 56.3	52.6
16	58 56.2	52.3
17	73 56.1	52.1
18	88 56.0	+22 51.9
19	103 55.9	51.7
20	118 55.8	51.5
21	133 55.6	51.2
22	148 55.5	51.0
23	163 55.4	50.8
5 0	178 55.3	+22 50.6
1	193 55.2	50.3
2	208 55.1	50.1
3	223 55.0	49.9
4	238 54.9	49.7
5	253 54.8	49.4
6	268 54.6	+22 49.2
7	283 54.5	49.0
8	298 54.4	48.7
9	313 54.3	48.5
10	328 54.2	48.3
11	343 54.1	48.0
12	358 54.0	+22 47.8
13	13 53.9	47.6
14	28 53.8	47.3
15	43 53.7	47.1
16	58 53.6	46.9
17	73 53.4	46.6
18	88 53.3	+22 46.4
19	103 53.2	46.2
20	118 53.1	45.9
21	133 53.0	45.7
22	148 52.9	45.4
23	163 52.8	45.2
24	178 52.7	+22 44.9
code	—	— 2

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.6	−40 29.1
5	Achernar	336 00.1	−57 27.9
30	Acrux	174 00.0	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.9	+56 12.9
34	Alkaid	153 34.0	+49 32.8
55	Al Na'ir	28 39.6	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.1	+28 50.0
51	Altair	62 51.8	+ 8 44.6
2	Ankaa	353 59.8	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.4
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.6	+ 6 18.7
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.1
12	Capella	281 41.4	+45 57.2
53	Deneb	50 01.8	+45 06.7
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.9	−18 14.2
27	Dubhe	194 46.8	+62 00.4
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.0	+ 9 39.7
56	Fomalhaut	16 13.2	−29 51.9
31	Gacrux	172 51.3	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.8	−60 09.4
6	Hamal	328 51.7	+23 14.6
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 16.9	+74 20.9
57	Markab	14 23.0	+14 57.3
8	Menkar	315 02.3	+ 3 54.6
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.4	−69 31.7
9	Mirfak	309 45.2	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.3	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.1	−60 39.1
44	Sabik	103 03.8	−15 40.3
3	Schedar	350 32.0	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.3
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 3	4	5
h	m s	m s	m s
0	− 3 56.7	− 4 07.8	− 4 18.6
6	− 3 59.5	− 4 10.5	− 4 21.2
12	− 4 02.3	− 4 13.2	− 4 23.8
18	− 4 05.0	− 4 15.9	− 4 26.4
24	− 4 07.8	− 4 18.6	− 4 29.0

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 3 h m	4 h m	5 h m	6 h m
72	▭	▭	21 53	21 06	▭	▭
70	▭	▭	22 06	21 35	20 31	▭
68	▭	▭	22 17	21 56	21 24	▭
66	0 39	////	22 26	22 13	21 57	21 23
64	1 46	////	22 33	22 28	22 21	22 13
62	2 20	////	22 40	22 40	22 41	22 45
60	2 45	////	22 46	22 50	22 57	23 09
58	3 05	////	22 51	22 59	23 10	23 28
56	3 21	////	22 55	23 07	23 22	23 44
54	3 34	////	22 59	23 14	23 32	23 58
52	3 46	////	23 03	23 20	23 42	24 10
50	3 57	////	23 06	23 26	23 50	24 20
45	4 19	1 48	23 14	23 39	24 08	0 08
40	4 36	2 34	23 20	23 49	24 22	0 22
35	4 51	3 04	23 25	23 58	24 34	0 34
30	5 03	3 27	23 30	24 06	0 06	0 45
20	5 25	4 01	23 38	24 20	0 20	1 04
10	5 43	4 26	23 46	24 32	0 32	1 20
0	6 01	4 45	23 53	24 43	0 43	1 36
10	6 18	5 03	24 00	0 00	0 55	1 51
20	6 36	5 18	24 07	0 07	1 07	2 08
30	6 56	5 31	24 16	0 16	1 22	2 28
35	7 08	5 39	24 21	0 21	1 30	2 39
40	7 22	5 45	24 27	0 27	1 40	2 52
45	7 39	5 53	24 34	0 34	1 51	3 08
50	7 59	6 00	24 42	0 42	2 05	3 27
52	8 08	6 04	24 46	0 46	2 11	3 36
54	8 19	6 07	24 50	0 50	2 18	3 46
56	8 31	6 11	24 55	0 55	2 26	3 58
58	8 45	6 15	25 00	1 00	2 35	4 11
60 S	9 02	6 19	25 06	1 06	2 46	4 27

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 3 h m	4 h m	5 h m	6 h m
72	▭	▭	12 54	15 27	▭	▭
70	▭	▭	12 44	15 01	17 54	▭
68	▭	▭	12 36	14 41	17 02	▭
66	23 24	////	12 29	14 25	16 30	18 58
64	22 21	////	12 23	14 13	16 07	18 08
62	21 47	////	12 18	14 02	15 48	17 37
60	21 23	////	12 14	13 53	15 33	17 14
58	21 03	////	12 10	13 45	15 21	16 56
56	20 47	////	12 07	13 38	15 10	16 40
54	20 34	////	12 04	13 32	15 00	16 27
52	20 22	////	12 01	13 26	14 51	16 15
50	20 11	////	11 59	13 21	14 44	16 05
45	19 50	22 19	11 54	13 11	14 27	15 43
40	19 32	21 33	11 49	13 02	14 14	15 26
35	19 18	21 04	11 46	12 54	14 03	15 12
30	19 05	20 41	11 42	12 47	13 53	14 59
20	18 44	20 08	11 37	12 36	13 36	14 38
10	18 25	19 42	11 32	12 26	13 22	14 19
0	18 08	19 23	11 27	12 17	13 08	14 02
10	17 51	19 06	11 22	12 07	12 54	13 45
20	17 33	18 51	11 17	11 57	12 40	13 26
30	17 12	18 37	11 12	11 46	12 24	13 05
35	17 00	18 30	11 08	11 40	12 14	12 53
40	16 47	18 24	11 05	11 32	12 03	12 39
45	16 30	18 16	11 01	11 24	11 50	12 22
50	16 10	18 09	10 56	11 14	11 35	12 02
52	16 01	18 06	10 53	11 09	11 28	11 52
54	15 50	18 02	10 51	11 04	11 20	11 41
56	15 38	17 59	10 48	10 58	11 11	11 29
58	15 24	17 55	10 45	10 52	11 01	11 15
60 S	15 07	17 51	10 41	10 45	10 50	10 58

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
3	5 15	8 53	12 11	10 01	18 34
4	6 05	8 53	12 10	9 58	18 30
5	6 56	8 53	12 09	9 55	18 26
6	7 49	8 53	12 08	9 52	18 23

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	3 ′	4 ′	5 ′
0	18.5	18.1	17.6
4	18.5	18.1	17.6
8	18.4	18.1	17.6
12	18.4	18.0	17.5
16	18.4	18.0	17.5
20	18.3	18.0	17.5
24	18.2	17.9	17.4
28	18.2	17.8	17.4
32	18.1	17.8	17.3
36	18.0	17.7	17.2
40	17.9	17.6	17.2
44	17.8	17.5	17.1
48	17.7	17.4	17.0
52	17.5	17.3	16.9
56	17.4	17.2	16.8
60	17.3	17.0	16.7
64	17.1	16.9	16.6
68	17.0	16.8	16.5
72	16.8	16.6	16.4
76	16.7	16.5	16.3
80	16.5	16.4	16.2
84	16.3	16.2	16.1
88	16.2	16.1	16.0
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	3 ′	4 ′	5 ′
0	13.9	14.1	14.4
4	13.9	14.1	14.4
8	13.9	14.1	14.4
12	13.9	14.2	14.4
16	14.0	14.2	14.5
20	14.0	14.2	14.5
24	14.1	14.3	14.5
28	14.2	14.4	14.6
32	14.3	14.4	14.7
36	14.4	14.5	14.7
40	14.5	14.6	14.8
44	14.6	14.7	14.9
48	14.7	14.8	15.0
52	14.8	14.9	15.0
56	15.0	15.0	15.1
60	15.1	15.2	15.2
64	15.2	15.3	15.3
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.9	15.8	15.8
84	16.0	16.0	15.9
88	16.1	16.1	16.0
90			

Subtract from table, back cover

Last Quarter 3
Independence Day 4

GMT	♈ GHA	VENUS −3.8 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
6 h													
0	283 40.8	226 43.1	+16 55.1	177 50.9	+23 35.5	211 48.9	+21 47.5	83 37.5	− 5 43.8	247 03.0	86	+20 00.1	+106
1	298 43.2	241 42.9	55.7	192 51.6	35.3	226 50.8	47.5	98 39.9	43.8	261 30.6	86	20 10.7	+105
2	313 45.7	256 42.8	56.3	207 52.3	35.2	241 52.7	47.6	113 42.4	43.9	275 58.2	84	20 21.2	+103
3	328 48.1	271 42.6	·· 56.9	222 52.9	·· 35.0	256 54.6	·· 47.7	128 44.8	·· 43.9	290 25.6	85	·20 31.5	+102
4	343 50.6	286 42.5	57.5	237 53.6	34.8	271 56.5	47.8	143 47.2	43.9	304 53.1	83	20 41.7	+102
5	358 53.1	301 42.3	58.1	252 54.3	34.7	286 58.3	47.8	158 49.6	44.0	319 20.4	83	20 51.9	+ 99
6	13 55.5	316 42.1	+16 58.7	267 55.0	+23 34.5	302 00.2	+21 47.9	173 52.1	− 5 44.0	333 47.7	83	+21 01.8	+ 99
7	28 58.0	331 42.0	59.3	282 55.7	34.3	317 02.1	48.0	188 54.5	44.0	348 15.0	81	21 11.7	+ 97
8	44 00.5	346 41.8	16 59.8	297 56.3	34.2	332 04.0	48.0	203 56.9	44.0	2 42.1	82	21 21.4	+ 96
9	59 02.9	1 41.7	·17 00.4	312 57.0	·· 34.0	347 05.9	·· 48.1	218 59.3	·· 44.1	17 09.3	80	·21 31.0	+ 95
10	74 05.4	16 41.5	01.0	327 57.7	33.8	2 07.8	48.2	234 01.7	44.1	31 36.3	81	21 40.5	+ 93
11	89 07.9	31 41.3	01.6	342 58.4	33.7	17 09.7	48.2	249 04.2	44.1	46 03.4	79	21 49.8	+ 92
12	104 10.3	46 41.2	+17 02.2	357 59.1	+23 33.5	32 11.6	+21 48.3	264 06.6	− 5 44.2	60 30.3	79	+21 59.0	+ 91
13	119 12.8	61 41.0	02.8	12 59.7	33.3	47 13.4	48.4	279 09.0	44.2	74 57.2	79	22 08.1	+ 89
14	134 15.2	76 40.8	03.4	28 00.4	33.2	62 15.3	48.4	294 11.4	44.2	89 24.1	77	22 17.0	+ 88
15	149 17.7	91 40.7	·· 04.0	43 01.1	·· 33.0	77 17.2	·· 48.5	309 13.8	·· 44.3	103 50.8	78	·22 25.8	+ 87
16	164 20.2	106 40.5	04.6	58 01.8	32.8	92 19.1	48.6	324 16.2	44.3	118 17.6	77	22 34.5	+ 86
17	179 22.6	121 40.3	05.2	73 02.5	32.6	107 21.0	48.6	339 18.7	44.3	132 44.3	76	22 43.1	+ 83
18	194 25.1	136 40.2	+17 05.8	88 03.2	+23 32.5	122 22.9	+21 48.7	354 21.1	− 5 44.3	147 10.9	76	+22 51.4	+ 83
19	209 27.6	151 40.0	06.3	103 03.8	32.3	137 24.8	48.8	9 23.5	44.4	161 37.5	75	22 59.7	+ 81
20	224 30.0	166 39.8	06.9	118 04.5	32.1	152 26.6	48.8	24 25.9	44.4	176 04.0	74	23 07.8	+ 80
21	239 32.5	181 39.6	·· 07.5	133 05.2	·· 32.0	167 28.5	·· 48.9	39 28.3	·· 44.4	190 30.4	75	·23 15.8	+ 78
22	254 35.0	196 39.5	08.1	148 05.9	31.8	182 30.4	49.0	54 30.8	44.5	204 56.9	73	23 23.6	+ 77
23	269 37.4	211 39.3	08.7	163 06.6	31.6	197 32.3	49.0	69 33.2	44.5	219 23.2	74	23 31.3	+ 76
7													
0	284 39.9	226 39.1	+17 09.3	178 07.3	+23 31.4	212 34.2	+21 49.1	84 35.6	− 5 44.5	233 49.6	72	+23 38.9	+ 74
1	299 42.4	241 38.9	09.9	193 07.9	31.3	227 36.1	49.2	99 38.0	44.6	248 15.8	73	23 46.3	+ 72
2	314 44.8	256 38.8	10.4	208 08.6	31.1	242 38.0	49.2	114 40.4	44.6	262 42.1	71	23 53.5	+ 72
3	329 47.3	271 38.6	·· 11.0	223 09.3	·· 30.9	257 39.9	·· 49.3	129 42.8	·· 44.6	277 08.2	72	·24 00.7	+ 69
4	344 49.7	286 38.4	11.6	238 10.0	30.7	272 41.7	49.4	144 45.3	44.6	291 34.4	71	24 07.6	+ 68
5	359 52.2	301 38.2	12.2	253 10.7	30.6	287 43.6	49.5	159 47.7	44.7	306 00.5	70	24 14.4	+ 67
6	14 54.7	316 38.1	+17 12.8	268 11.4	+23 30.4	302 45.5	+21 49.5	174 50.1	− 5 44.7	320 26.5	70	+24 21.1	+ 65
7	29 57.1	331 37.9	13.4	283 12.0	30.2	317 47.4	49.6	189 52.5	44.7	334 52.5	70	24 27.6	+ 64
8	44 59.6	346 37.7	14.0	298 12.7	30.1	332 49.3	49.7	204 54.9	44.8	349 18.5	69	24 34.0	+ 62
9	60 02.1	1 37.5	·· 14.5	313 13.4	·· 29.9	347 51.2	·· 49.7	219 57.3	·· 44.8	3 44.4	69	·24 40.2	+ 61
10	75 04.5	16 37.3	15.1	328 14.1	29.7	2 53.1	49.8	234 59.8	44.8	18 10.3	68	24 46.3	+ 59
11	90 07.0	31 37.2	15.7	343 14.8	29.5	17 55.0	49.9	250 02.2	44.9	32 36.1	69	24 52.2	+ 58
12	105 09.5	46 37.0	+17 16.3	358 15.5	+23 29.3	32 56.8	+21 49.9	265 04.6	− 5 44.9	47 02.0	67	+24 58.0	+ 56
13	120 11.9	61 36.8	16.9	13 16.1	29.2	47 58.7	50.0	280 07.0	44.9	61 27.7	68	25 03.6	+ 55
14	135 14.4	76 36.6	17.4	28 16.8	29.0	63 00.6	50.1	295 09.4	45.0	75 53.5	67	25 09.1	+ 53
15	150 16.9	91 36.4	·· 18.0	43 17.5	·· 28.8	78 02.5	·· 50.1	310 11.8	·· 45.0	90 19.2	67	·25 14.4	+ 51
16	165 19.3	106 36.2	18.6	58 18.2	28.6	93 04.4	50.2	325 14.3	45.0	104 44.9	66	25 19.5	+ 50
17	180 21.8	121 36.1	19.2	73 18.9	28.5	108 06.3	50.3	340 16.7	45.1	119 10.5	67	25 24.5	+ 48
18	195 24.2	136 35.9	+17 19.8	88 19.6	+23 28.3	123 08.2	+21 50.3	355 19.1	− 5 45.1	133 36.2	66	+25 29.3	+ 47
19	210 26.7	151 35.7	20.3	103 20.3	28.1	138 10.1	50.4	10 21.5	45.1	148 01.8	65	25 34.0	+ 45
20	225 29.2	166 35.5	20.9	118 20.9	27.9	153 12.0	50.5	25 23.9	45.1	162 27.3	66	25 38.5	+ 44
21	240 31.6	181 35.3	·· 21.5	133 21.6	·· 27.7	168 13.8	·· 50.5	40 26.3	·· 45.2	176 52.9	65	·25 42.9	+ 42
22	255 34.1	196 35.1	22.1	148 22.3	27.6	183 15.7	50.6	55 28.7	45.2	191 18.4	65	25 47.1	+ 41
23	270 36.6	211 34.9	22.7	163 23.0	27.4	198 17.6	50.7	70 31.2	45.2	205 43.9	65	25 51.2	+ 39
8													
0	285 39.0	226 34.7	+17 23.2	178 23.7	+23 27.2	213 19.5	+21 50.7	85 33.6	− 5 45.3	220 09.4	65	+25 55.1	+ 37
1	300 41.5	241 34.5	23.8	193 24.4	27.0	228 21.4	50.8	100 36.0	45.3	234 34.9	65	25 58.8	+ 36
2	315 44.0	256 34.3	24.4	208 25.1	26.8	243 23.3	50.9	115 38.4	45.3	249 00.4	64	26 02.4	+ 34
3	330 46.4	271 34.2	·· 25.0	223 25.7	·· 26.7	258 25.2	·· 50.9	130 40.8	·· 45.4	263 25.8	65	·26 05.8	+ 32
4	345 48.9	286 34.0	25.5	238 26.4	26.5	273 27.1	51.0	145 43.2	45.4	277 51.3	64	26 09.0	+ 31
5	0 51.4	301 33.8	26.1	253 27.1	26.3	288 29.0	51.1	160 45.6	45.4	292 16.7	64	26 12.1	+ 30
6	15 53.8	316 33.6	+17 26.7	268 27.8	+23 26.1	303 30.9	+21 51.1	175 48.0	− 5 45.5	306 42.1	64	+26 15.1	+ 28
7	30 56.3	331 33.4	27.3	283 28.5	25.9	318 32.7	51.2	190 50.5	45.5	321 07.5	64	26 17.9	+ 26
8	45 58.7	346 33.2	27.8	298 29.2	25.7	333 34.6	51.3	205 52.9	45.5	335 32.9	64	26 20.5	+ 24
9	61 01.2	1 33.0	·· 28.4	313 29.9	·· 25.6	348 36.5	·· 51.3	220 55.3	·· 45.6	349 58.3	65	·26 22.9	+ 23
10	76 03.7	16 32.8	29.0	328 30.6	25.4	3 38.4	51.4	235 57.7	45.6	4 23.8	64	26 25.2	+ 21
11	91 06.1	31 32.6	29.6	343 31.2	25.2	18 40.3	51.5	251 00.1	45.6	18 49.2	64	26 27.3	+ 20
12	106 08.6	46 32.4	+17 30.1	358 31.9	+23 25.0	33 42.2	+21 51.5	266 02.5	− 5 45.7	33 14.6	64	+26 29.3	+ 18
13	121 11.1	61 32.2	30.7	13 32.6	24.8	48 44.1	51.6	281 04.9	45.7	47 40.0	64	26 31.1	+ 17
14	136 13.5	76 32.0	31.3	28 33.3	24.6	63 46.0	51.6	296 07.3	45.7	62 05.4	64	26 32.8	+ 15
15	151 16.0	91 31.8	·· 31.8	43 34.0	·· 24.5	78 47.9	·· 51.7	311 09.8	·· 45.8	76 30.8	64	·26 34.3	+ 13
16	166 18.5	106 31.6	32.4	58 34.7	24.3	93 49.8	51.8	326 12.2	45.8	90 56.2	65	26 35.6	+ 12
17	181 20.9	121 31.4	33.0	73 35.4	24.1	108 51.7	51.8	341 14.6	45.8	105 21.7	64	26 36.8	+ 10
18	196 23.4	136 31.2	+17 33.6	88 36.1	+23 23.9	123 53.5	+21 51.9	356 17.0	− 5 45.9	119 47.1	65	+26 37.8	+ 8
19	211 25.8	151 31.0	34.1	103 36.8	23.7	138 55.4	52.0	11 19.4	45.9	134 12.6	65	26 38.6	+ 7
20	226 28.3	166 30.8	34.7	118 37.4	23.5	153 57.3	52.0	26 21.8	45.9	148 38.1	65	26 39.3	+ 5
21	241 30.8	181 30.6	·· 35.3	133 38.1	·· 23.3	168 59.2	·· 52.1	41 24.2	·· 46.0	163 03.6	65	·26 39.8	+ 4
22	256 33.2	196 30.3	35.8	148 38.8	23.2	184 01.1	52.2	56 26.6	46.0	177 29.1	66	26 40.2	+ 2
23	271 35.7	211 30.1	36.4	163 39.5	23.0	199 03.0	52.2	71 29.0	46.0	191 54.7	65	26 40.4	+ 1
24	286 38.2	226 29.9	+17 37.0	178 40.2	+23 22.8	214 04.9	+21 52.3	86 31.4	− 5 46.1	206 20.2	66	+26 40.5	− 1
code	−	− 2	+ 6	+ 6	− 1	+ 19	+ 1	+ 24	0				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
6 h 0	178 52.7	+22 44.9
1	193 52.6	44.7
2	208 52.5	44.5
3	223 52.4	44.2
4	238 52.3	44.0
5	253 52.2	43.7
6	268 52.0	+22 43.5
7	283 51.9	43.2
8	298 51.8	43.0
9	313 51.7	42.7
10	328 51.6	42.5
11	343 51.5	42.2
12	358 51.4	+22 42.0
13	13 51.3	41.7
14	28 51.2	41.5
15	43 51.1	41.2
16	58 51.0	41.0
17	73 50.9	40.7
18	88 50.8	+22 40.5
19	103 50.7	40.2
20	118 50.6	40.0
21	133 50.5	39.7
22	148 50.4	39.5
23	163 50.3	39.2
7 h 0	178 50.2	+22 38.9
1	193 50.0	38.7
2	208 49.9	38.4
3	223 49.8	38.2
4	238 49.7	37.9
5	253 49.6	37.6
6	268 49.5	+22 37.4
7	283 49.4	37.1
8	298 49.3	36.8
9	313 49.2	36.6
10	328 49.1	36.3
11	343 49.0	36.0
12	358 48.9	+22 35.8
13	13 48.8	35.5
14	28 48.7	35.2
15	43 48.6	35.0
16	58 48.5	34.7
17	73 48.4	34.4
18	88 48.3	+22 34.2
19	103 48.2	33.9
20	118 48.1	33.6
21	133 48.0	33.3
22	148 47.9	33.1
23	163 47.8	32.8
8 h 0	178 47.7	+22 32.5
1	193 47.6	32.3
2	208 47.5	32.0
3	223 47.4	31.7
4	238 47.3	31.4
5	253 47.2	31.1
6	268 47.1	+22 30.9
7	283 47.0	30.6
8	298 46.9	30.3
9	313 46.8	30.0
10	328 46.7	29.7
11	343 46.6	29.5
12	358 46.5	+22 29.2
13	13 46.4	28.9
14	28 46.3	28.6
15	43 46.2	28.3
16	58 46.1	28.0
17	73 46.0	27.8
18	88 45.9	+22 27.5
19	103 45.8	27.2
20	118 45.7	26.9
21	133 45.6	26.6
22	148 45.5	26.3
23	163 45.4	26.0
24	178 45.3	+22 25.7
code	—	-3

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.5	−40 29.1
5	Achernar	336 00.1	−57 27.9
30	Acrux	174 00.0	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.9	+56 12.9
34	Alkaid	153 34.0	+49 32.8
55	Al Na'ir	28 39.6	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.0	+28 50.0
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.8	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.4
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.7
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.0
12	Capella	281 41.4	+45 57.2
53	Deneb	50 01.8	+45 06.7
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.9	−18 14.2
27	Dubhe	194 46.8	+62 00.3
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.0	+ 9 39.7
56	Fomalhaut	16 13.2	−29 51.9
31	Gacrux	172 51.4	−56 51.6
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.8	−60 09.4
6	Hamal	328 51.7	+23 14.6
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.0	+74 20.9
57	Markab	14 23.0	+14 57.3
8	Menkar	315 02.3	+ 3 54.7
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.4	−69 31.7
9	Mirfak	309 45.2	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.3	−56 53.0
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.8	+12 35.5
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.6	− 8 15.1
38	Rigil Kent.	140 53.2	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 32.0	+56 16.8
45	Shaula	97 22.6	−37 04.4
18	Sirius	259 13.7	−16 38.9
33	Spica	159 18.6	−10 55.3
23	Suhail	223 26.0	−43 14.8
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.2

GMT h	Equation of Time (App.—Mean) 6 m s	7 m s	8 m s
0	− 4 29.0	− 4 39.2	− 4 49.0
6	− 4 31.6	− 4 41.7	− 4 51.4
12	− 4 34.2	− 4 44.1	− 4 53.8
18	− 4 36.7	− 4 46.6	− 4 56.1
24	− 4 39.2	− 4 49.0	− 4 58.4

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 6 h m	7 h m	8 h m	9 h m
72	▭	▭	▭	▭	▭	▭
70	▭	▭	▭	▭	▭	▭
68	▭	▭	▭	▭	▭	▭
66	0 56	////	21 23	▭	▭	▭
64	1 53	////	22 13	21 55	▭	23 37
62	2 25	////	22 45	22 57	23 34	24 50
60	2 49	////	23 09	23 32	24 15	0 15
58	3 08	////	23 28	23 57	24 44	0 44
56	3 24	////	23 44	24 17	0 17	1 06
54	3 37	////	23 58	24 34	0 34	1 24
52	3 49	////	24 10	0 10	0 48	1 40
50	3 59	////	24 20	0 20	1 01	1 53
45	4 21	1 53	0 08	0 43	1 27	2 20
40	4 38	2 36	0 22	1 01	1 48	2 42
35	4 52	3 07	0 34	1 16	2 05	3 00
30	5 05	3 29	0 45	1 30	2 20	3 15
20	5 26	4 03	1 04	1 52	2 45	3 42
10	5 44	4 27	1 20	2 12	3 07	4 04
0	6 01	4 46	1 36	2 31	3 28	4 25
10	6 18	5 03	1 51	2 50	3 49	4 46
20	6 36	5 18	2 08	3 10	4 11	5 09
30	6 56	5 31	2 28	3 33	4 37	5 35
35	7 08	5 38	2 39	3 47	4 52	5 51
40	7 22	5 45	2 52	4 03	5 10	6 09
45	7 38	5 52	3 08	4 22	5 31	6 31
50	7 57	6 00	3 27	4 46	5 58	6 58
52	8 07	6 02	3 36	4 58	6 12	7 12
54	8 17	6 06	3 46	5 11	6 27	7 27
56	8 29	6 10	3 58	5 27	6 45	7 46
58	8 43	6 14	4 11	5 45	7 07	8 08
60 S	8 59	6 17	4 27	6 07	7 35	8 37

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 6 h m	7 h m	8 h m	9 h m
72	▭	▭	▭	▭	▭	▭
70	▭	▭	▭	▭	▭	▭
68	▭	▭	▭	▭	▭	▭
66	23 09	////	18 58	▭	▭	▭
64	22 15	////	18 08	20 25	▭	22 42
62	21 43	////	17 37	19 23	20 47	21 28
60	21 19	////	17 14	18 49	20 05	20 52
58	21 01	////	16 56	18 24	19 36	20 26
56	20 45	////	16 40	18 04	19 14	20 05
54	20 32	////	16 27	17 48	18 56	19 48
52	20 20	////	16 15	17 34	18 41	19 34
50	20 10	////	16 05	17 21	18 28	19 21
45	19 49	22 16	15 43	16 56	18 00	18 55
40	19 31	21 31	15 26	16 35	17 39	18 34
35	19 17	21 02	15 12	16 19	17 21	18 16
30	19 05	20 40	14 59	16 04	17 05	18 01
20	18 44	20 07	14 38	15 39	16 39	17 35
10	18 25	19 42	14 19	15 18	16 17	17 13
0	18 08	19 23	14 02	14 58	15 55	16 53
10	17 52	19 07	13 45	14 38	15 34	16 32
20	17 34	18 52	13 26	14 17	15 12	16 09
30	17 14	18 39	13 05	13 53	14 46	15 43
35	17 02	18 32	12 53	13 38	14 30	15 28
40	16 48	18 25	12 39	13 22	14 12	15 10
45	16 32	18 18	12 22	13 02	13 50	14 49
50	16 13	18 11	12 02	12 37	13 23	14 21
52	16 03	18 07	11 52	12 25	13 10	14 08
54	15 53	18 05	11 41	12 12	12 54	13 53
56	15 41	18 01	11 29	11 56	12 36	13 34
58	15 27	17 57	11 15	11 37	12 14	13 12
60 S	15 11	17 53	10 58	11 14	11 46	12 44

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
6	7 49	8 53	12 08	9 52	18 23
7	8 44	8 54	12 07	9 49	18 19
8	9 42	8 54	12 06	9 46	18 15
9	10 39	8 54	12 05	9 42	18 11

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	6 ′	7 ′	8 ′
0	17.1	16.4	15.8
4	17.1	16.4	15.8
8	17.1	16.4	15.8
12	17.0	16.4	15.8
16	17.0	16.4	15.8
20	17.0	16.4	15.8
24	17.0	16.4	15.8
28	16.9	16.3	15.8
32	16.9	16.3	15.8
36	16.8	16.3	15.8
40	16.8	16.3	15.8
44	16.7	16.2	15.7
48	16.6	16.2	15.7
52	16.6	16.2	15.7
56	16.5	16.1	15.7
60	16.4	16.1	15.7
64	16.4	16.0	15.7
68	16.3	16.0	15.7
72	16.2	15.9	15.7
76	16.1	15.9	15.6
80	16.0	15.8	15.6
84	16.0	15.8	15.6
88	15.9	15.8	15.6
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	6 ′	7 ′	8 ′
0	14.7	15.0	15.4
4	14.7	15.0	15.4
8	14.7	15.1	15.4
12	14.7	15.1	15.4
16	14.7	15.1	15.4
20	14.8	15.1	15.4
24	14.8	15.1	15.4
28	14.8	15.1	15.4
32	14.9	15.2	15.4
36	14.9	15.2	15.4
40	15.0	15.2	15.5
44	15.0	15.3	15.5
48	15.1	15.3	15.5
52	15.2	15.3	15.5
56	15.2	15.4	15.5
60	15.3	15.4	15.5
64	15.4	15.5	15.5
68	15.5	15.5	15.5
72	15.5	15.5	15.6
76	15.6	15.6	15.6
80	15.7	15.6	15.6
84	15.8	15.7	15.6
88	15.9	15.7	15.6
90			

Subtract from table, back cover

918768°—52——9

GMT	♈ GHA	VENUS −3.8 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
9 0	286 38.2	226 29.9	+17 37.0	178 40.2	+23 22.8	214 04.9	+21 52.3	86 31.4	− 5 46.1	206 20.2	66	+26 40.5	− 1
1	301 40.6	241 29.7	37.5	193 40.9	22.6	229 06.8	52.4	101 33.9	46.1	220 45.8	67	26 40.4	− 3
2	316 43.1	256 29.5	38.1	208 41.6	22.4	244 08.7	52.4	116 36.3	46.1	235 11.5	66	26 40.1	− 4
3	331 45.6	271 29.3	•• 38.7	223 42.3	•• 22.2	259 10.6	•• 52.5	131 38.7	•• 46.2	249 37.1	67	•26 39.7	− 6
4	346 48.0	286 29.1	39.2	238 43.0	22.0	274 12.5	52.6	146 41.1	46.2	264 02.8	67	26 39.1	− 8
5	1 50.5	301 28.9	39.8	253 43.6	21.8	289 14.3	52.6	161 43.5	46.2	278 28.5	68	26 38.3	− 9
6	16 53.0	316 28.7	+17 40.4	268 44.3	+23 21.6	304 16.2	+21 52.7	176 45.9	− 5 46.3	292 54.3	67	+26 37.4	− 10
7	31 55.4	331 28.5	40.9	283 45.0	21.5	319 18.1	52.8	191 48.3	46.3	307 20.0	69	26 36.4	− 12
8	46 57.9	346 28.2	41.5	298 45.7	21.3	334 20.0	52.8	206 50.7	46.3	321 45.9	68	26 35.2	− 14
9	62 00.3	1 28.0	•• 42.0	313 46.4	•• 21.1	349 21.9	•• 52.9	221 53.1	•• 46.4	336 11.7	69	•26 33.8	− 15
10	77 02.8	16 27.8	42.6	328 47.1	20.9	4 23.8	53.0	236 55.5	46.4	350 37.6	70	26 32.3	− 17
11	92 05.3	31 27.6	43.2	343 47.8	20.7	19 25.7	53.0	251 57.9	46.4	5 03.6	70	26 30.6	− 18
12	107 07.7	46 27.4	+17 43.7	358 48.5	+23 20.5	34 27.6	+21 53.1	267 00.4	− 5 46.5	19 29.6	70	+26 28.8	− 20
13	122 10.2	61 27.2	44.3	13 49.2	20.3	49 29.5	53.2	282 02.8	46.5	33 55.6	71	26 26.8	− 21
14	137 12.7	76 26.9	44.9	28 49.9	20.1	64 31.4	53.2	297 05.2	46.5	48 21.7	71	26 24.7	− 23
15	152 15.1	91 26.7	•• 45.4	43 50.6	•• 19.9	79 33.3	•• 53.3	312 07.6	•• 46.6	62 47.8	72	•26 22.4	− 25
16	167 17.6	106 26.5	46.0	58 51.3	19.7	94 35.2	53.3	327 10.0	46.6	77 14.0	72	26 19.9	− 25
17	182 20.1	121 26.3	46.5	73 51.9	19.5	109 37.1	53.4	342 12.4	46.6	91 40.2	73	26 17.4	− 28
18	197 22.5	136 26.1	+17 47.1	88 52.6	+23 19.3	124 39.0	+21 53.5	357 14.8	− 5 46.7	106 06.5	73	+26 14.6	− 29
19	212 25.0	151 25.8	47.7	103 53.3	19.1	139 40.8	53.5	12 17.2	46.7	120 32.8	74	26 11.7	− 30
20	227 27.5	166 25.6	48.2	118 54.0	18.9	154 42.7	53.6	27 19.6	46.7	134 59.2	75	26 08.7	− 32
21	242 29.9	181 25.4	•• 48.8	133 54.7	•• 18.8	169 44.6	•• 53.7	42 22.0	•• 46.8	149 25.7	75	•26 05.5	− 33
22	257 32.4	196 25.2	49.3	148 55.4	18.6	184 46.5	53.7	57 24.4	46.8	163 52.2	76	26 02.2	− 35
23	272 34.8	211 24.9	49.9	163 56.1	18.4	199 48.4	53.8	72 26.8	46.9	178 18.8	76	25 58.7	− 36
10 0	287 37.3	226 24.7	+17 50.4	178 56.8	+23 18.2	214 50.3	+21 53.9	87 29.2	− 5 46.9	192 45.4	77	+25 55.1	− 38
1	302 39.8	241 24.5	51.0	193 57.5	18.0	229 52.2	53.9	102 31.6	46.9	207 12.1	78	25 51.3	− 39
2	317 42.2	256 24.3	51.6	208 58.2	17.8	244 54.1	54.0	117 34.0	47.0	221 38.9	78	25 47.4	− 40
3	332 44.7	271 24.0	•• 52.1	223 58.9	•• 17.6	259 56.0	•• 54.1	132 36.5	•• 47.0	236 05.7	79	•25 43.4	− 42
4	347 47.2	286 23.8	52.7	238 59.6	17.4	274 57.9	54.1	147 38.9	47.0	250 32.6	80	25 39.2	− 43
5	2 49.6	301 23.6	53.2	254 00.3	17.2	289 59.8	54.2	162 41.3	47.1	264 59.6	80	25 34.9	− 45
6	17 52.1	316 23.4	+17 53.8	269 00.9	+23 17.0	305 01.7	+21 54.2	177 43.7	− 5 47.1	279 26.6	81	+25 30.4	− 46
7	32 54.6	331 23.1	54.3	284 01.6	16.8	320 03.6	54.3	192 46.1	47.1	293 53.7	82	25 25.8	− 47
8	47 57.0	346 22.9	54.9	299 02.3	16.6	335 05.5	54.4	207 48.5	47.2	308 20.9	82	25 21.1	− 49
9	62 59.5	1 22.7	•• 55.4	314 03.0	•• 16.4	350 07.4	•• 54.4	222 50.9	•• 47.2	322 48.1	84	•25 16.2	− 50
10	78 02.0	16 22.4	56.0	329 03.7	16.2	5 09.3	54.5	237 53.3	47.2	337 15.5	84	25 11.2	− 52
11	93 04.4	31 22.2	56.5	344 04.4	16.0	20 11.2	54.6	252 55.7	47.3	351 42.9	84	25 06.0	− 53
12	108 06.9	46 22.0	+17 57.1	359 05.1	+23 15.8	35 13.1	+21 54.6	267 58.1	− 5 47.3	6 10.3	86	+25 00.7	− 54
13	123 09.3	61 21.7	57.6	14 05.8	15.6	50 14.9	54.7	283 00.5	47.3	20 37.9	86	24 55.3	− 55
14	138 11.8	76 21.5	58.2	29 06.5	15.4	65 16.8	54.8	298 02.9	47.4	35 05.5	87	24 49.8	− 57
15	153 14.3	91 21.3	•• 58.7	44 07.2	•• 15.2	80 18.7	•• 54.8	313 05.3	•• 47.4	49 33.2	88	•24 44.1	− 58
16	168 16.7	106 21.0	59.3	59 07.9	15.0	95 20.6	54.9	328 07.7	47.5	64 01.0	89	24 38.3	− 60
17	183 19.2	121 20.8	17 59.8	74 08.6	14.8	110 22.5	54.9	343 10.1	47.5	78 28.9	89	24 32.3	− 60
18	198 21.7	136 20.5	+18 00.4	89 09.3	+23 14.6	125 24.4	+21 55.0	358 12.5	− 5 47.5	92 56.8	91	+24 26.3	− 62
19	213 24.1	151 20.3	00.9	104 10.0	14.4	140 26.3	55.1	13 14.9	47.6	107 24.9	91	24 20.1	− 63
20	228 26.6	166 20.1	01.5	119 10.7	14.2	155 28.2	55.1	28 17.3	47.6	121 53.0	92	24 13.8	− 65
21	243 29.1	181 19.8	•• 02.0	134 11.4	•• 14.0	170 30.1	•• 55.2	43 19.7	•• 47.6	136 21.2	92	•24 07.3	− 65
22	258 31.5	196 19.6	02.6	149 12.1	13.8	185 32.0	55.3	58 22.1	47.7	150 49.4	94	24 00.8	− 67
23	273 34.0	211 19.3	03.1	164 12.8	13.6	200 33.9	55.3	73 24.5	47.7	165 17.8	94	23 54.1	− 68
11 0	288 36.5	226 19.1	+18 03.7	179 13.5	+23 13.4	215 35.8	+21 55.4	88 26.9	− 5 47.7	179 46.2	96	+23 47.3	− 69
1	303 38.9	241 18.9	04.2	194 14.2	13.2	230 37.7	55.5	103 29.3	47.8	194 14.8	96	23 40.4	− 70
2	318 41.4	256 18.6	04.8	209 14.8	13.0	245 39.6	55.5	118 31.7	47.8	208 43.4	97	23 33.4	− 72
3	333 43.8	271 18.4	•• 05.3	224 15.5	•• 12.8	260 41.5	•• 55.6	133 34.1	•• 47.9	223 12.1	98	•23 26.2	− 73
4	348 46.3	286 18.1	05.8	239 16.2	12.6	275 43.4	55.6	148 36.5	47.9	237 40.9	99	23 18.9	− 73
5	3 48.8	301 17.9	06.4	254 16.9	12.3	290 45.3	55.7	163 38.9	47.9	252 09.8	99	23 11.6	− 75
6	18 51.2	316 17.6	+18 06.9	269 17.6	+23 12.1	305 47.2	+21 55.8	178 41.3	− 5 48.0	266 38.7	101	+23 04.1	− 76
7	33 53.7	331 17.4	07.5	284 18.3	11.9	320 49.1	55.8	193 43.7	48.0	281 07.8	101	22 56.5	− 78
8	48 56.2	346 17.1	08.0	299 19.0	11.7	335 51.0	55.9	208 46.1	48.0	295 36.9	103	22 48.7	− 78
9	63 58.6	1 16.9	•• 08.6	314 19.7	•• 11.5	350 52.9	•• 56.0	223 48.5	•• 48.1	310 06.2	103	•22 40.9	− 79
10	79 01.1	16 16.6	09.1	329 20.4	11.3	5 54.8	56.0	238 51.0	48.1	324 35.5	104	22 33.0	− 81
11	94 03.6	31 16.4	09.6	344 21.1	11.1	20 56.7	56.1	253 53.4	48.1	339 04.9	105	22 24.9	− 81
12	109 06.0	46 16.1	+18 10.2	359 21.8	+23 10.9	35 58.6	+21 56.1	268 55.8	− 5 48.2	353 34.4	106	+22 16.8	− 83
13	124 08.5	61 15.9	10.7	14 22.5	10.7	51 00.5	56.2	283 58.2	48.2	8 04.0	106	22 08.5	− 83
14	139 10.9	76 15.6	11.3	29 23.2	10.5	66 02.4	56.3	299 00.6	48.3	22 33.6	108	22 00.2	− 85
15	154 13.4	91 15.4	•• 11.8	44 23.9	•• 10.3	81 04.3	•• 56.3	314 03.0	•• 48.3	37 03.4	109	•21 51.7	− 85
16	169 15.9	106 15.1	12.3	59 24.6	10.1	96 06.2	56.4	329 05.4	48.3	51 33.3	109	21 43.2	− 87
17	184 18.3	121 14.9	12.9	74 25.3	09.9	111 08.0	56.5	344 07.8	48.4	66 03.2	110	21 34.5	− 87
18	199 20.8	136 14.6	+18 13.4	89 26.0	+23 09.7	126 09.9	+21 56.5	359 10.2	− 5 48.4	80 33.2	112	+21 25.8	− 89
19	214 23.3	151 14.4	13.9	104 26.7	09.4	141 11.8	56.6	14 12.6	48.4	95 03.4	112	21 16.9	− 90
20	229 25.7	166 14.1	14.5	119 27.4	09.2	156 13.7	56.6	29 14.9	48.5	109 33.6	113	21 07.9	− 90
21	244 28.2	181 13.9	•• 15.0	134 28.1	•• 09.0	171 15.6	•• 56.7	44 17.3	•• 48.5	124 03.9	114	•20 58.9	− 91
22	259 30.7	196 13.6	15.5	149 28.8	08.8	186 17.5	56.8	59 19.7	48.6	138 34.3	115	20 49.8	− 93
23	274 33.1	211 13.3	16.1	164 29.5	08.6	201 19.4	56.8	74 22.1	48.6	153 04.8	115	20 40.5	− 93
24	289 35.6	226 13.1	+18 16.6	179 30.2	+23 08.4	216 21.3	+21 56.9	89 24.5	− 5 48.6	167 35.3	117	+20 31.2	− 94
code	—	− 3	+ 5	+ 7	− 2	+ 18	+ 1	+ 24	0				

GMT	SUN GHA	SUN Dec.
9 h 0	178 45.3	+22 25.7
1	193 45.3	25.4
2	208 45.2	25.1
3	223 45.1	24.9
4	238 45.0	24.6
5	253 44.9	24.3
6	268 44.8	+22 24.0
7	283 44.7	23.7
8	298 44.6	23.4
9	313 44.5	23.1
10	328 44.4	22.8
11	343 44.3	22.5
12	358 44.2	+22 22.2
13	13 44.1	21.9
14	28 44.0	21.6
15	43 43.9	21.3
16	58 43.8	21.0
17	73 43.7	20.7
18	88 43.6	+22 20.4
19	103 43.5	20.1
20	118 43.5	19.8
21	133 43.4	19.5
22	148 43.3	19.2
23	163 43.2	18.9
10 h 0	178 43.1	+22 18.5
1	193 43.0	18.2
2	208 42.9	17.9
3	223 42.8	17.6
4	238 42.7	17.3
5	253 42.6	17.0
6	268 42.5	+22 16.7
7	283 42.4	16.4
8	298 42.4	16.1
9	313 42.3	15.7
10	328 42.2	15.4
11	343 42.1	15.1
12	358 42.0	+22 14.8
13	13 41.9	14.5
14	28 41.8	14.2
15	43 41.7	13.9
16	58 41.6	13.5
17	73 41.6	13.2
18	88 41.5	+22 12.9
19	103 41.4	12.6
20	118 41.3	12.3
21	133 41.2	11.9
22	148 41.1	11.6
23	163 41.0	11.3
11 h 0	178 40.9	+22 11.0
1	193 40.8	10.6
2	208 40.8	10.3
3	223 40.7	10.0
4	238 40.6	09.7
5	253 40.5	09.3
6	268 40.4	+22 09.0
7	283 40.3	08.7
8	298 40.2	08.4
9	313 40.2	08.0
10	328 40.1	07.7
11	343 40.0	07.4
12	358 39.9	+22 07.0
13	13 39.8	06.7
14	28 39.7	06.4
15	43 39.6	06.0
16	58 39.6	05.7
17	73 39.5	05.4
18	88 39.4	+22 05.0
19	103 39.3	04.7
20	118 39.2	04.4
21	133 39.1	04.0
22	148 39.1	03.7
23	163 39.0	03.4
24	178 38.9	+22 03.0
code	—	- 3

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.5	−40 29.1
5	Achernar	336 00.0	−57 27.9
30	Acrux	174 00.0	−62 50.9
19	Adhara	255 48.3	−28 54.4
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.9	+56 12.9
34	Alkaid	153 34.0	+49 32.8
55	Al Na'ir	28 39.6	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.2
1	Alpheratz	358 30.0	+28 50.0
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.8	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.4
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.7
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.0
12	Capella	281 41.4	+45 57.2
53	Deneb	50 01.8	+45 06.8
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.9	−18 14.2
27	Dubhe	194 46.8	+62 00.3
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 06.5	+51 29.6
54	Enif	34 31.0	+ 9 39.7
56	Fomalhaut	16 13.2	−29 51.9
31	Gacrux	172 51.4	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.8	−60 09.4
6	Hamal	328 51.7	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.0	+74 20.9
57	Markab	14 23.0	+14 57.3
8	Menkar	315 02.2	+ 3 54.7
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.4	−69 31.7
9	Mirfak	309 45.1	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.8	+12 35.5
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.5	− 8 15.1
38	Rigil Kent.	140 53.2	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 32.0	+56 16.8
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.7	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 9	10	11
h	m s	m s	m s
0	− 4 58.4	− 5 07.5	− 5 16.1
6	− 5 00.7	− 5 09.7	− 5 18.2
12	− 5 03.0	− 5 11.8	− 5 20.2
18	− 5 05.3	− 5 14.0	− 5 22.3
24	− 5 07.5	− 5 16.1	− 5 24.3

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 9 h m	10 h m	11 h m	12 h m
72	▭	▭	▭	▭	▭	▭
70	▭	▭	▭	▭	▭	▭
68	▭	▭	▭	▭	▭	2 38
66	1 11	////	▭	▭	0 48	3 19
64	2 01	////	23 37	25 53	1 53	3 47
62	2 31	////	24 50	0 50	2 28	4 08
60	2 54	////	0 15	1 26	2 53	4 25
58	3 12	////	0 44	1 52	3 14	4 39
56	3 27	////	1 06	2 12	3 30	4 51
54	3 40	////	1 24	2 29	3 44	5 02
52	3 52	////	1 40	2 44	3 56	5 12
50	4 02	////	1 53	2 56	4 07	5 20
45	4 23	1 57	2 20	3 22	4 29	5 38
40	4 40	2 39	2 42	3 43	4 47	5 52
35	4 54	3 08	3 00	4 00	5 02	6 04
30	5 06	3 31	3 15	4 15	5 15	6 15
20	5 27	4 04	3 42	4 40	5 37	6 33
10	5 45	4 28	4 04	5 01	5 57	6 49
0	6 02	4 47	4 25	5 21	6 14	7 04
10	6 18	5 03	4 46	5 41	6 32	7 19
20	6 36	5 18	5 09	6 03	6 51	7 34
30	6 56	5 31	5 35	6 28	7 13	7 52
35	7 07	5 37	5 51	6 42	7 26	8 02
40	7 20	5 44	6 09	6 59	7 40	8 14
45	7 36	5 51	6 31	7 19	7 58	8 28
50	7 56	5 58	6 58	7 45	8 19	8 45
52	8 05	6 01	7 12	7 57	8 29	8 53
54	8 15	6 05	7 27	8 11	8 41	9 01
56	8 26	6 08	7 46	8 27	8 54	9 11
58	8 40	6 12	8 08	8 46	9 09	9 23
60	8 56	6 15	8 37	9 10	9 27	9 35

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 9 h m	10 h m	11 h m	12 h m
72	▭	▭	▭	▭	▭	23 52
70	▭	▭	▭	▭	▭	23 10
68	▭	▭	▭	▭	23 20	22 42
66	22 56	////	▭	23 26	22 38	22 20
64	22 08	////	22 42	22 18	22 09	22 03
62	21 38	////	21 28	21 42	21 47	21 48
60	21 15	////	20 52	21 17	21 29	21 36
58	20 57	////	20 26	20 56	21 14	21 25
56	20 42	////	20 05	20 39	21 01	21 16
54	20 29	////	19 48	20 25	20 50	21 08
52	20 18	////	19 34	20 12	20 40	21 00
50	20 08	////	19 21	20 01	20 31	20 54
45	19 47	22 11	18 55	19 38	20 12	20 39
40	19 30	21 29	18 34	19 19	19 57	20 28
35	19 16	21 00	18 16	19 04	19 44	20 17
30	19 04	20 39	18 01	18 50	19 32	20 08
20	18 43	20 06	17 35	18 27	19 12	19 53
10	18 26	19 43	17 13	18 06	18 55	19 39
0	18 09	19 23	16 53	17 47	18 39	19 26
10	17 53	19 08	16 32	17 28	18 22	19 13
20	17 35	18 53	16 09	17 08	18 05	18 59
30	17 15	18 40	15 43	16 44	17 44	18 43
35	17 03	18 33	15 28	16 30	17 32	18 34
40	16 50	18 27	15 10	16 13	17 18	18 23
45	16 34	18 20	14 49	15 54	17 02	18 10
50	16 15	18 13	14 21	15 29	16 42	17 55
52	16 06	18 10	14 08	15 17	16 32	17 47
54	15 56	18 07	13 53	15 03	16 21	17 39
56	15 44	18 03	13 34	14 47	16 08	17 30
58	15 31	18 00	13 12	14 29	15 54	17 20
60	15 15	17 56	12 44	14 05	15 37	17 08

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
9	10 39	8 54	12 05	9 42	18 11
10	11 34	8 55	12 04	9 39	18 07
11	12 27	8 55	12 03	9 36	18 03
12	13 15	8 55	12 01	9 33	18 00

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	9 ′	10 ′	11 ′
0	15.2	14.5	13.9
4	15.2	14.5	13.9
8	15.2	14.5	13.9
12	15.2	14.6	13.9
16	15.2	14.6	14.0
20	15.2	14.6	14.0
24	15.2	14.6	14.0
28	15.2	14.6	14.1
32	15.2	14.7	14.1
36	15.2	14.7	14.2
40	15.2	14.7	14.2
44	15.3	14.8	14.3
48	15.3	14.8	14.4
52	15.3	14.9	14.4
56	15.3	14.9	14.5
60	15.3	15.0	14.6
64	15.3	15.0	14.7
68	15.4	15.1	14.8
72	15.4	15.1	14.8
76	15.4	15.2	14.9
80	15.4	15.2	15.0
84	15.4	15.3	15.1
88	15.5	15.3	15.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	9 ′	10 ′	11 ′
0	15.8	16.1	16.5
4	15.8	16.1	16.5
8	15.8	16.1	16.5
12	15.8	16.1	16.5
16	15.8	16.1	16.4
20	15.7	16.1	16.4
24	15.7	16.1	16.4
28	15.7	16.0	16.3
32	15.7	16.0	16.3
36	15.7	16.0	16.2
40	15.7	15.9	16.2
44	15.7	15.9	16.1
48	15.7	15.8	16.0
52	15.6	15.8	16.0
56	15.6	15.8	15.9
60	15.6	15.7	15.8
64	15.6	15.7	15.7
68	15.6	15.6	15.6
72	15.6	15.6	15.6
76	15.5	15.5	15.5
80	15.5	15.4	15.4
84	15.5	15.4	15.3
88	15.5	15.3	15.2
90			

Subtract from table, back cover

New Moon 11

GMT	♈ GHA	VENUS −3.7 GHA	VENUS −3.7 Dec.	MARS 1.9 GHA	MARS 1.9 Dec.	JUPITER −1.6 GHA	JUPITER −1.6 Dec.	SATURN 1.0 GHA	SATURN 1.0 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
12 0	289 35.6	226 13.1	+18 16.6	179 30.2	+23 08.4	216 21.3	+21 56.9	89 24.5	− 5 48.6	167 35.3	117	+20 31.2	− 94
1	304 38.1	241 12.8	17.1	194 30.9	08.2	231 23.2	57.0	104 26.9	48.7	182 06.0	117	20 21.8	− 95
2	319 40.5	256 12.6	17.7	209 31.6	08.0	246 25.1	57.0	119 29.3	48.7	196 36.7	119	20 12.3	− 96
3	334 43.0	271 12.3	•• 18.2	224 32.3	•• 07.8	261 27.0	•• 57.1	134 31.7	•• 48.8	211 07.6	119	•20 02.7	− 97
4	349 45.4	286 12.0	18.7	239 33.0	07.5	276 28.9	57.1	149 34.1	48.8	225 38.5	120	19 53.0	− 97
5	4 47.9	301 11.8	19.3	254 33.7	07.3	291 30.8	57.2	164 36.5	48.8	240 09.5	121	19 43.3	− 99
6	19 50.4	316 11.5	+18 19.8	269 34.4	+23 07.1	306 32.7	+21 57.3	179 38.9	− 5 48.9	254 40.6	122	+19 33.4	− 99
7	34 52.8	331 11.3	20.3	284 35.1	06.9	321 34.6	57.3	194 41.3	48.9	269 11.8	122	19 23.5	−100
8	49 55.3	346 11.0	20.9	299 35.8	06.7	336 36.5	57.4	209 43.7	48.9	283 43.0	124	19 13.5	−101
9	64 57.8	1 10.7	•• 21.4	314 36.5	•• 06.5	351 38.4	•• 57.4	224 46.1	•• 49.0	298 14.4	125	•19 03.4	−102
10	80 00.2	16 10.5	21.9	329 37.2	06.3	6 40.3	57.5	239 48.5	49.0	312 45.9	125	18 53.2	−102
11	95 02.7	31 10.2	22.5	344 37.9	06.1	21 42.2	57.6	254 50.9	49.1	327 17.4	126	18 43.0	−103
12	110 05.2	46 09.9	+18 23.0	359 38.6	+23 05.8	36 44.1	+21 57.6	269 53.3	− 5 49.1	341 49.0	127	+18 32.7	−104
13	125 07.6	61 09.7	23.5	14 39.3	05.6	51 46.0	57.7	284 55.7	49.1	356 20.7	128	18 22.3	−105
14	140 10.1	76 09.4	24.0	29 40.0	05.4	66 47.9	57.8	299 58.1	49.2	10 52.5	129	18 11.8	−105
15	155 12.6	91 09.1	•• 24.6	44 40.7	•• 05.2	81 49.8	•• 57.8	315 00.5	•• 49.2	25 24.4	129	•18 01.3	−107
16	170 15.0	106 08.9	25.1	59 41.4	05.0	96 51.7	57.9	330 02.9	49.3	39 56.3	130	17 50.6	−107
17	185 17.5	121 08.6	25.6	74 42.1	04.8	111 53.6	57.9	345 05.3	49.3	54 28.3	132	17 39.9	−107
18	200 19.9	136 08.3	+18 26.1	89 42.8	+23 04.5	126 55.5	+21 58.0	0 07.7	− 5 49.3	69 00.5	132	+17 29.2	−108
19	215 22.4	151 08.0	26.7	104 43.5	04.3	141 57.4	58.1	15 10.1	49.4	83 32.7	132	17 18.4	−109
20	230 24.9	166 07.8	27.2	119 44.2	04.1	156 59.3	58.1	30 12.5	49.4	98 04.9	134	17 07.5	−110
21	245 27.3	181 07.5	•• 27.7	134 44.9	•• 03.9	172 01.2	•• 58.2	45 14.9	•• 49.5	112 37.3	134	•16 56.5	−110
22	260 29.8	196 07.2	28.2	149 45.6	03.7	187 03.1	58.2	60 17.3	49.5	127 09.7	136	16 45.5	−111
23	275 32.3	211 07.0	28.8	164 46.3	03.5	202 05.0	58.3	75 19.7	49.5	141 42.3	136	16 34.4	−112
13 0	290 34.7	226 06.7	+18 29.3	179 47.0	+23 03.2	217 06.9	+21 58.4	90 22.1	− 5 49.6	156 14.9	136	+16 23.2	−112
1	305 37.2	241 06.4	29.8	194 47.7	03.0	232 08.8	58.4	105 24.5	49.6	170 47.5	138	16 12.0	−113
2	320 39.7	256 06.1	30.3	209 48.4	02.8	247 10.7	58.5	120 26.9	49.6	185 20.3	138	16 00.7	−113
3	335 42.1	271 05.9	•• 30.8	224 49.2	•• 02.6	262 12.6	•• 58.5	135 29.2	•• 49.7	199 53.1	139	•15 49.4	−114
4	350 44.6	286 05.6	31.4	239 49.9	02.4	277 14.5	58.6	150 31.6	49.7	214 26.0	140	15 38.0	−115
5	5 47.1	301 05.3	31.9	254 50.6	02.1	292 16.4	58.7	165 34.0	49.8	228 59.0	141	15 26.5	−115
6	20 49.5	316 05.0	+18 32.4	269 51.3	+23 01.9	307 18.3	+21 58.7	180 36.4	− 5 49.8	243 32.1	141	+15 15.0	−116
7	35 52.0	331 04.7	32.9	284 52.0	01.7	322 20.2	58.8	195 38.8	49.8	258 05.2	142	15 03.4	−116
8	50 54.4	346 04.5	33.4	299 52.7	01.5	337 22.1	58.8	210 41.2	49.9	272 38.4	143	14 51.8	−117
9	65 56.9	1 04.2	•• 33.9	314 53.4	•• 01.3	352 24.0	•• 58.9	225 43.6	•• 49.9	287 11.7	143	•14 40.1	−117
10	80 59.4	16 03.9	34.5	329 54.1	01.0	7 26.0	59.0	240 46.0	50.0	301 45.0	144	14 28.4	−118
11	96 01.8	31 03.6	35.0	344 54.8	00.8	22 27.9	59.0	255 48.4	50.0	316 18.4	145	14 16.6	−118
12	111 04.3	46 03.3	+18 35.5	359 55.5	+23 00.6	37 29.8	+21 59.1	270 50.8	− 5 50.0	330 51.9	146	+14 04.8	−119
13	126 06.8	61 03.1	36.0	14 56.2	00.4	52 31.7	59.2	285 53.2	50.1	345 25.5	146	13 52.9	−119
14	141 09.2	76 02.8	36.5	29 56.9	23 00.1	67 33.6	59.2	300 55.6	50.1	359 59.1	147	13 41.0	−120
15	156 11.7	91 02.5	•• 37.0	44 57.6	•22 59.9	82 35.5	•• 59.3	315 58.0	•• 50.2	14 32.8	147	•13 29.0	−121
16	171 14.2	106 02.2	37.5	59 58.3	59.7	97 37.4	59.3	331 00.4	50.2	29 06.5	149	13 16.9	−120
17	186 16.6	121 01.9	38.1	74 59.0	59.5	112 39.3	59.4	346 02.8	50.2	43 40.4	148	13 04.9	−122
18	201 19.1	136 01.6	+18 38.6	89 59.7	+22 59.3	127 41.2	+21 59.5	1 05.1	− 5 50.3	58 14.2	150	+12 52.7	−121
19	216 21.5	151 01.3	39.1	105 00.4	59.0	142 43.1	59.5	16 07.5	50.3	72 48.2	150	12 40.6	−122
20	231 24.0	166 01.1	39.6	120 01.1	58.8	157 45.0	59.6	31 09.9	50.4	87 22.2	151	12 28.4	−123
21	246 26.5	181 00.8	•• 40.1	135 01.8	•• 58.6	172 46.9	•• 59.6	46 12.3	•• 50.4	101 56.3	151	•12 16.1	−123
22	261 28.9	196 00.5	40.6	150 02.5	58.4	187 48.8	59.7	61 14.7	50.5	116 30.4	152	12 03.8	−123
23	276 31.4	211 00.2	41.1	165 03.3	58.1	202 50.7	59.8	76 17.1	50.5	131 04.6	153	11 51.5	−124
14 0	291 33.9	225 59.9	+18 41.6	180 04.0	+22 57.9	217 52.6	+21 59.8	91 19.5	− 5 50.5	145 38.9	153	+11 39.1	−124
1	306 36.3	240 59.6	42.1	195 04.7	57.7	232 54.5	59.9	106 21.9	50.6	160 13.2	154	11 26.7	−124
2	321 38.8	255 59.3	42.6	210 05.4	57.5	247 56.4	21 59.9	121 24.3	50.6	174 47.6	154	11 14.3	−125
3	336 41.3	270 59.0	•• 43.2	225 06.1	•• 57.2	262 58.3	•22 00.0	136 26.7	•• 50.7	189 22.0	155	•11 01.8	−125
4	351 43.7	285 58.7	43.7	240 06.8	57.0	278 00.2	00.1	151 29.1	50.7	203 56.5	155	10 49.3	−126
5	6 46.2	300 58.4	44.2	255 07.5	56.8	293 02.1	00.1	166 31.4	50.7	218 31.0	156	10 36.7	−126
6	21 48.7	315 58.1	+18 44.7	270 08.2	+22 56.5	308 04.0	+22 00.2	181 33.8	− 5 50.8	233 05.6	157	+10 24.1	−126
7	36 51.1	330 57.8	45.2	285 08.9	56.3	323 05.9	00.2	196 36.2	50.8	247 40.3	157	10 11.5	−126
8	51 53.6	345 57.5	45.7	300 09.6	56.1	338 07.8	00.3	211 38.6	50.9	262 15.0	157	9 58.9	−127
9	66 56.0	0 57.2	•• 46.2	315 10.3	•• 55.9	353 09.7	•• 00.3	226 41.0	•• 50.9	276 49.7	158	• 9 46.2	−127
10	81 58.5	15 57.0	46.7	330 11.0	55.6	8 11.6	00.4	241 43.4	50.9	291 24.5	159	9 33.5	−128
11	97 01.0	30 56.7	47.2	345 11.7	55.4	23 13.5	00.5	256 45.8	51.0	305 59.4	159	9 20.7	−127
12	112 03.4	45 56.4	+18 47.7	0 12.4	+22 55.2	38 15.4	+22 00.5	271 48.2	− 5 51.0	320 34.3	159	+ 9 08.0	−128
13	127 05.9	60 56.1	48.2	15 13.2	54.9	53 17.3	00.6	286 50.6	51.1	335 09.2	160	8 55.2	−129
14	142 08.4	75 55.8	48.7	30 13.9	54.7	68 19.3	00.6	301 53.0	51.1	349 44.2	161	8 42.3	−128
15	157 10.8	90 55.5	•• 49.2	45 14.6	•• 54.5	83 21.2	•• 00.7	316 55.3	•• 51.2	4 19.3	161	• 8 29.5	−129
16	172 13.3	105 55.2	49.7	60 15.3	54.3	98 23.1	00.8	331 57.7	51.2	18 54.4	161	8 16.6	−129
17	187 15.8	120 54.9	50.2	75 16.0	54.0	113 25.0	00.8	347 00.1	51.2	33 29.5	162	8 03.7	−129
18	202 18.2	135 54.5	+18 50.7	90 16.7	+22 53.8	128 26.9	+22 00.9	2 02.5	− 5 51.3	48 04.7	162	+ 7 50.8	−130
19	217 20.7	150 54.2	51.2	105 17.4	53.6	143 28.8	00.9	17 04.9	51.3	62 39.9	162	7 37.8	−129
20	232 23.2	165 53.9	51.7	120 18.1	53.3	158 30.7	01.0	32 07.3	51.4	77 15.1	163	7 24.9	−130
21	247 25.6	180 53.6	•• 52.2	135 18.8	•• 53.1	173 32.6	•• 01.1	47 09.7	•• 51.4	91 50.4	164	• 7 11.9	−131
22	262 28.1	195 53.3	52.7	150 19.5	52.9	188 34.5	01.1	62 12.1	51.4	106 25.8	163	6 58.8	−130
23	277 30.5	210 53.0	53.2	165 20.3	52.6	203 36.4	01.2	77 14.4	51.5	121 01.1	164	6 45.8	−130
24	292 33.0	225 52.7	+18 53.7	180 21.0	+22 52.4	218 38.3	+22 01.2	92 16.8	− 5 51.5	135 36.5	165	+ 6 32.8	−131
code	−	− 2	+ 5	+ 7	− 2	+ 19	+ 1	+ 24	− 1				

GMT		SUN GHA	SUN Dec.
	h	° ′	° ′
12	0	178 38.9	+22 03.0
	1	193 38.8	02.7
	2	208 38.7	02.3
	3	223 38.6	02.0
	4	238 38.6	01.7
	5	253 38.5	01.3
	6	268 38.4	+22 01.0
	7	283 38.3	00.6
	8	298 38.2	22 00.3
	9	313 38.2	21 59.9
	10	328 38.1	59.6
	11	343 38.0	59.2
	12	358 37.9	+21 58.9
	13	13 37.8	58.6
	14	28 37.7	58.2
	15	43 37.7	57.9
	16	58 37.6	57.5
	17	73 37.5	57.2
	18	88 37.4	+21 56.8
	19	103 37.3	56.5
	20	118 37.3	56.1
	21	133 37.2	55.7
	22	148 37.1	55.4
	23	163 37.0	55.0
13	0	178 37.0	+21 54.7
	1	193 36.9	54.3
	2	208 36.8	54.0
	3	223 36.7	53.6
	4	238 36.6	53.3
	5	253 36.6	52.9
	6	268 36.5	+21 52.5
	7	283 36.4	52.2
	8	298 36.3	51.8
	9	313 36.3	51.5
	10	328 36.2	51.1
	11	343 36.1	50.7
	12	358 36.0	+21 50.4
	13	13 36.0	50.0
	14	28 35.9	49.7
	15	43 35.8	49.3
	16	58 35.7	48.9
	17	73 35.7	48.6
	18	88 35.6	+21 48.2
	19	103 35.5	47.8
	20	118 35.4	47.5
	21	133 35.4	47.1
	22	148 35.3	46.7
	23	163 35.2	46.3
14	0	178 35.1	+21 46.0
	1	193 35.1	45.6
	2	208 35.0	45.2
	3	223 34.9	44.9
	4	238 34.9	44.5
	5	253 34.8	44.1
	6	268 34.7	+21 43.7
	7	283 34.6	43.4
	8	298 34.6	43.0
	9	313 34.5	42.6
	10	328 34.4	42.2
	11	343 34.4	41.9
	12	358 34.3	+21 41.5
	13	13 34.2	41.1
	14	28 34.1	40.7
	15	43 34.1	40.3
	16	58 34.0	40.0
	17	73 33.9	39.6
	18	88 33.9	+21 39.2
	19	103 33.8	38.8
	20	118 33.7	38.4
	21	133 33.7	38.1
	22	148 33.6	37.7
	23	163 33.5	37.3
	24	178 33.5	+21 36.9
code		—	- 4

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.5	−40 29.0
5	Achernar	336 00.0	−57 27.9
30	Acrux	174 00.0	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.3	+16 25.1
32	Alioth	166 59.9	+56 12.9
34	Alkaid	153 34.0	+49 32.8
55	Al Na'ir	28 39.6	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.3
1	Alpheratz	358 30.0	+28 50.0
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.7	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.4
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.7
16	Betelg'se	271 50.3	+ 7 24.1
17	Canopus	264 16.7	−52 40.0
12	Capella	281 41.3	+45 57.2
53	Deneb	50 01.8	+45 06.8
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.8	−18 14.2
27	Dubhe	194 46.8	+62 00.3
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 06.5	+51 29.7
54	Enif	34 31.0	+ 9 39.7
56	Fomalhaut	16 13.2	−29 51.9
31	Gacrux	172 51.4	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.8	−60 09.4
6	Hamal	328 51.6	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.1	+74 20.9
57	Markab	14 22.9	+14 57.3
8	Menkar	315 02.2	+ 3 54.7
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.5	−69 31.7
9	Mirfak	309 45.1	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.8	+12 35.5
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.5	− 8 15.1
38	Rigil Kent.	140 53.2	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.9	+56 16.8
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.7	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 12	13	14
h	m s	m s	m s
0	− 5 24.3	− 5 32.0	− 5 39.3
6	− 5 26.3	− 5 33.9	− 5 41.0
12	− 5 28.2	− 5 35.7	− 5 42.7
18	− 5 30.1	− 5 37.5	− 5 44.4
24	− 5 32.0	− 5 39.3	− 5 46.0

Lat.	Sunrise	Twlt. begins	Moonrise 12	13	14	15
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	3 45	6 13	8 13
70	▭	▭	▭	4 25	6 30	8 20
68	▭	▭	2 38	4 52	6 44	8 25
66	1 25	////	3 19	5 13	6 55	8 30
64	2 09	////	3 47	5 29	7 04	8 34
62	2 37	////	4 08	5 42	7 12	8 37
60	2 59	////	4 25	5 54	7 19	8 40
58	3 17	////	4 39	6 03	7 25	8 43
56	3 31	////	4 51	6 12	7 30	8 45
54	3 44	////	5 02	6 19	7 34	8 47
52	3 55	////	5 12	6 26	7 39	8 49
50	4 05	0 22	5 20	6 32	7 42	8 51
45	4 25	2 02	5 38	6 45	7 51	8 54
40	4 42	2 43	5 52	6 56	7 57	8 57
35	4 56	3 11	6 04	7 05	8 03	9 00
30	5 08	3 33	6 15	7 13	8 08	9 02
20	5 28	4 05	6 33	7 27	8 17	9 06
10	5 46	4 29	6 49	7 38	8 25	9 10
0	6 02	4 48	7 04	7 50	8 32	9 13
10	6 18	5 03	7 19	8 01	8 40	9 16
20	6 35	5 17	7 34	8 12	8 47	9 20
30	6 55	5 30	7 52	8 26	8 56	9 24
35	7 06	5 37	8 02	8 33	9 01	9 26
40	7 19	5 44	8 14	8 42	9 07	9 29
45	7 35	5 50	8 28	8 52	9 13	9 32
50	7 53	5 57	8 45	9 05	9 21	9 35
52	8 02	6 00	8 53	9 10	9 24	9 37
54	8 12	6 03	9 01	9 17	9 28	9 38
56	8 24	6 06	9 11	9 24	9 33	9 40
58	8 36	6 10	9 23	9 31	9 38	9 43
60	8 52	6 13	9 35	9 40	9 43	9 45

Lat.	Sunset	Twlt. ends	Moonset 12	13	14	15
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	23 52	22 55	22 21	21 53
70	▭	▭	23 10	22 36	22 12	21 51
68	▭	▭	22 42	22 20	22 04	21 49
66	22 43	////	22 20	22 07	21 57	21 48
64	22 00	////	22 03	21 57	21 52	21 46
62	21 32	////	21 48	21 48	21 47	21 45
60	21 11	////	21 36	21 40	21 42	21 44
58	20 54	////	21 25	21 33	21 39	21 43
56	20 39	////	21 16	21 27	21 35	21 43
54	20 27	////	21 08	21 21	21 32	21 42
52	20 16	////	21 00	21 16	21 30	21 41
50	20 06	23 39	20 54	21 12	21 27	21 41
45	19 46	22 08	20 39	21 02	21 21	21 39
40	19 29	21 27	20 28	20 54	21 17	21 38
35	19 15	20 59	20 17	20 47	21 13	21 37
30	19 03	20 37	20 08	20 40	21 09	21 36
20	18 43	20 06	19 53	20 29	21 03	21 35
10	18 26	19 43	19 39	20 20	20 57	21 33
0	18 09	19 23	19 26	20 10	20 52	21 32
10	17 53	19 08	19 13	20 01	20 47	21 31
20	17 36	18 54	18 59	19 51	20 41	21 29
30	17 17	18 41	18 43	19 40	20 35	21 28
35	17 05	18 35	18 34	19 33	20 31	21 27
40	16 52	18 28	18 23	19 26	20 27	21 26
45	16 37	18 22	18 10	19 17	20 22	21 24
50	16 18	18 15	17 55	19 06	20 15	21 23
52	16 09	18 12	17 47	19 01	20 13	21 22
54	15 59	18 09	17 39	18 56	20 10	21 21
56	15 48	18 06	17 30	18 50	20 06	21 20
58	15 35	18 03	17 20	18 43	20 02	21 20
60	15 20	18 00	17 08	18 35	19 58	21 18

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
12	13 15	8 55	12 01	9 33	18 00
13	14 00	8 56	12 00	9 30	17 56
14	14 42	8 56	11 59	9 27	17 52
15	15 23	8 57	11 58	9 24	17 48

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	12	13	14
°	′	′	′
0	13.3	12.8	12.4
4	13.3	12.8	12.4
8	13.3	12.8	12.4
12	13.3	12.8	12.4
16	13.3	12.9	12.5
20	13.4	12.9	12.6
24	13.4	13.0	12.6
28	13.5	13.0	12.7
32	13.6	13.1	12.8
36	13.6	13.2	12.9
40	13.7	13.3	13.0
44	13.8	13.4	13.1
48	13.9	13.5	13.3
52	14.0	13.7	13.4
56	14.1	13.8	13.5
60	14.2	13.9	13.7
64	14.3	14.1	13.9
68	14.4	14.2	14.0
72	14.6	14.3	14.2
76	14.7	14.5	14.4
80	14.8	14.6	14.5
84	14.9	14.8	14.7
88	15.0	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	12	13	14
°	′	′	′
0	16.9	17.2	17.4
4	16.8	17.1	17.4
8	16.8	17.1	17.3
12	16.8	17.1	17.3
16	16.8	17.0	17.2
20	16.7	17.0	17.2
24	16.7	16.9	17.1
28	16.6	16.9	17.0
32	16.6	16.8	16.9
36	16.5	16.7	16.8
40	16.4	16.6	16.7
44	16.3	16.5	16.6
48	16.2	16.4	16.5
52	16.1	16.2	16.3
56	16.0	16.1	16.2
60	15.9	16.0	16.0
64	15.8	15.8	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.3	15.2
84	15.2	15.1	15.0
88	15.1	15.0	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.7 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
15 0	292 33.0	225 52.7	+18 53.7	180 21.0	+22 52.4	218 38.3	+22 01.2	92 16.8	− 5 51.5	135 36.5	165	+ 6 32.8	−131
1	307 35.5	240 52.4	54.2	195 21.7	52.2	233 40.2	01.3	107 19.2	51.6	150 12.0	164	6 19.7	−131
2	322 37.9	255 52.1	54.7	210 22.4	51.9	248 42.1	01.4	122 21.6	51.6	164 47.4	166	6 06.6	−131
3	337 40.4	270 51.8	•• 55.2	225 23.1	•• 51.7	263 44.0	•• 01.4	137 24.0	•• 51.7	179 23.0	165	• 5 53.5	−131
4	352 42.9	285 51.5	55.7	240 23.8	51.5	278 45.9	01.5	152 26.4	51.7	193 58.5	166	5 40.4	−132
5	7 45.3	300 51.2	56.2	255 24.5	51.2	293 47.8	01.5	167 28.8	51.7	208 34.1	166	5 27.2	−131
6	22 47.8	315 50.9	+18 56.6	270 25.2	+22 51.0	308 49.7	+22 01.6	182 31.2	− 5 51.8	223 09.7	166	+ 5 14.1	−132
7	37 50.3	330 50.6	57.1	285 25.9	50.8	323 51.7	01.6	197 33.5	51.8	237 45.3	167	5 00.9	−132
8	52 52.7	345 50.2	57.6	300 26.6	50.5	338 53.6	01.7	212 35.9	51.9	252 21.0	166	4 47.7	−132
9	67 55.2	0 49.9	•• 58.1	315 27.4	•• 50.3	353 55.5	•• 01.8	227 38.3	•• 51.9	266 56.6	168	• 4 34.5	−132
10	82 57.6	15 49.6	58.6	330 28.1	50.0	8 57.4	01.8	242 40.7	52.0	281 32.4	167	4 21.3	−132
11	98 00.1	30 49.3	59.1	345 28.8	49.8	23 59.3	01.9	257 43.1	52.0	296 08.1	168	4 08.1	−132
12	113 02.6	45 49.0	+18 59.6	0 29.5	+22 49.6	39 01.2	+22 01.9	272 45.5	− 5 52.0	310 43.9	167	+ 3 54.9	−132
13	128 05.0	60 48.7	19 00.1	15 30.2	49.3	54 03.1	02.0	287 47.9	52.1	325 19.6	168	3 41.7	−133
14	143 07.5	75 48.4	00.6	30 30.9	49.1	69 05.0	02.0	302 50.2	52.1	339 55.4	169	3 28.4	−132
15	158 10.0	90 48.0	•• 01.0	45 31.6	•• 48.9	84 06.9	•• 02.1	317 52.6	•• 52.2	354 31.3	168	• 3 15.2	−133
16	173 12.4	105 47.7	01.5	60 32.3	48.6	99 08.8	02.2	332 55.0	52.2	9 07.1	169	3 01.9	−133
17	188 14.9	120 47.4	02.0	75 33.1	48.4	114 10.7	02.2	347 57.4	52.3	23 43.0	169	2 48.6	−133
18	203 17.4	135 47.1	+19 02.5	90 33.8	+22 48.1	129 12.6	+22 02.3	2 59.8	− 5 52.3	38 18.9	169	+ 2 35.3	−132
19	218 19.8	150 46.8	03.0	105 34.5	47.9	144 14.5	02.3	18 02.2	52.3	52 54.8	169	2 22.1	−133
20	233 22.3	165 46.5	03.5	120 35.2	47.7	159 16.5	02.4	33 04.5	52.4	67 30.7	169	2 08.8	−133
21	248 24.8	180 46.1	•• 04.0	135 35.9	•• 47.4	174 18.4	•• 02.5	48 06.9	•• 52.4	82 06.6	170	• 1 55.5	−133
22	263 27.2	195 45.8	04.4	150 36.6	47.2	189 20.3	02.5	63 09.3	52.5	96 42.6	169	1 42.2	−133
23	278 29.7	210 45.5	04.9	165 37.3	46.9	204 22.2	02.6	78 11.7	52.5	111 18.5	170	1 28.9	−133
16 0	293 32.1	225 45.2	+19 05.4	180 38.1	+22 46.7	219 24.1	+22 02.6	93 14.1	− 5 52.6	125 54.5	170	+ 1 15.6	−133
1	308 34.6	240 44.8	05.9	195 38.8	46.5	234 26.0	02.7	108 16.5	52.6	140 30.5	170	1 02.3	−133
2	323 37.1	255 44.5	06.4	210 39.5	46.2	249 27.9	02.7	123 18.8	52.7	155 06.5	170	0 49.0	−133
3	338 39.5	270 44.2	•• 06.8	225 40.2	•• 46.0	264 29.8	•• 02.8	138 21.2	•• 52.7	169 42.5	170	• 0 35.7	−133
4	353 42.0	285 43.9	07.3	240 40.9	45.7	279 31.7	02.9	153 23.6	52.7	184 18.5	170	0 22.4	−133
5	8 44.5	300 43.6	07.8	255 41.6	45.5	294 33.6	02.9	168 26.0	52.8	198 54.5	170	+ 0 09.1	−133
6	23 46.9	315 43.2	+19 08.3	270 42.3	+22 45.3	309 35.5	+22 03.0	183 28.4	− 5 52.8	213 30.5	170	− 0 04.2	−133
7	38 49.4	330 42.9	08.8	285 43.1	45.0	324 37.5	03.0	198 30.8	52.9	228 06.5	171	0 17.5	−133
8	53 51.9	345 42.6	09.2	300 43.8	44.8	339 39.4	03.1	213 33.1	52.9	242 42.6	170	0 30.8	−133
9	68 54.3	0 42.2	•• 09.7	315 44.5	•• 44.5	354 41.3	•• 03.1	228 35.5	•• 53.0	257 18.6	170	• 0 44.1	−132
10	83 56.8	15 41.9	10.2	330 45.2	44.3	9 43.2	03.2	243 37.9	53.0	271 54.6	170	0 57.3	−133
11	98 59.3	30 41.6	10.7	345 45.9	44.0	24 45.1	03.3	258 40.3	53.1	286 30.6	171	1 10.6	−133
12	114 01.7	45 41.3	+19 11.1	0 46.6	+22 43.8	39 47.0	+22 03.3	273 42.7	− 5 53.1	301 06.7	170	− 1 23.9	−133
13	129 04.2	60 40.9	11.6	15 47.3	43.6	54 48.9	03.4	288 45.1	53.1	315 42.7	170	1 37.2	−132
14	144 06.6	75 40.6	12.1	30 48.1	43.3	69 50.8	03.4	303 47.4	53.2	330 18.7	170	1 50.4	−133
15	159 09.1	90 40.3	•• 12.6	45 48.8	•• 43.1	84 52.7	•• 03.5	318 49.8	•• 53.2	344 54.7	170	• 2 03.7	−132
16	174 11.6	105 39.9	13.0	60 49.5	42.8	99 54.6	03.5	333 52.2	53.3	359 30.7	170	2 16.9	−132
17	189 14.0	120 39.6	13.5	75 50.2	42.6	114 56.6	03.6	348 54.6	53.3	14 06.7	170	2 30.1	−133
18	204 16.5	135 39.3	+19 14.0	90 50.9	+22 42.3	129 58.5	+22 03.7	3 57.0	− 5 53.4	28 42.7	170	− 2 43.4	−132
19	219 19.0	150 38.9	14.4	105 51.6	42.1	145 00.4	03.7	18 59.3	53.4	43 18.7	170	2 56.6	−132
20	234 21.4	165 38.6	14.9	120 52.4	41.8	160 02.3	03.8	34 01.7	53.5	57 54.7	170	3 09.8	−132
21	249 23.9	180 38.3	•• 15.4	135 53.1	•• 41.6	175 04.2	•• 03.8	49 04.1	•• 53.5	72 30.7	169	• 3 23.0	−132
22	264 26.4	195 37.9	15.9	150 53.8	41.3	190 06.1	03.9	64 06.5	53.5	87 06.6	170	3 36.2	−131
23	279 28.8	210 37.6	16.3	165 54.5	41.1	205 08.0	03.9	79 08.9	53.6	101 42.6	169	3 49.3	−132
17 0	294 31.3	225 37.3	+19 16.8	180 55.2	+22 40.8	220 09.9	+22 04.0	94 11.2	− 5 53.6	116 18.5	169	− 4 02.5	−131
1	309 33.7	240 36.9	17.3	195 55.9	40.6	235 11.8	04.1	109 13.6	53.7	130 54.4	169	4 15.6	−131
2	324 36.2	255 36.6	17.7	210 56.7	40.4	250 13.8	04.1	124 16.0	53.7	145 30.3	169	4 28.7	−132
3	339 38.7	270 36.2	•• 18.2	225 57.4	•• 40.1	265 15.7	•• 04.2	139 18.4	•• 53.8	160 06.2	169	• 4 41.9	−130
4	354 41.1	285 35.9	18.7	240 58.1	39.9	280 17.6	04.2	154 20.8	53.8	174 42.1	168	4 54.9	−131
5	9 43.6	300 35.6	19.1	255 58.8	39.6	295 19.5	04.3	169 23.1	53.9	189 17.9	168	5 08.0	−131
6	24 46.1	315 35.2	+19 19.6	270 59.5	+22 39.4	310 21.4	+22 04.3	184 25.5	− 5 53.9	203 53.7	168	− 5 21.1	−130
7	39 48.5	330 34.9	20.0	286 00.3	39.1	325 23.3	04.4	199 27.9	54.0	218 29.5	168	5 34.1	−130
8	54 51.0	345 34.5	20.5	301 01.0	38.9	340 25.2	04.4	214 30.3	54.0	233 05.3	168	5 47.1	−131
9	69 53.5	0 34.2	•• 21.0	316 01.7	•• 38.6	355 27.1	•• 04.5	229 32.7	•• 54.0	247 41.1	167	• 6 00.2	−129
10	84 55.9	15 33.8	21.4	331 02.4	38.4	10 29.1	04.6	244 35.0	54.1	262 16.8	167	6 13.1	−130
11	99 58.4	30 33.5	21.9	346 03.1	38.1	25 31.0	04.6	259 37.4	54.1	276 52.5	167	6 26.1	−129
12	115 00.9	45 33.2	+19 22.4	1 03.9	+22 37.9	40 32.9	+22 04.7	274 39.8	− 5 54.2	291 28.2	167	− 6 39.0	−130
13	130 03.3	60 32.8	22.8	16 04.6	37.6	55 34.8	04.7	289 42.2	54.2	306 03.9	166	6 52.0	−129
14	145 05.8	75 32.5	23.3	31 05.3	37.3	70 36.7	04.8	304 44.5	54.3	320 39.5	166	7 04.9	−128
15	160 08.2	90 32.1	•• 23.7	46 06.0	•• 37.1	85 38.6	•• 04.8	319 46.9	•• 54.3	335 15.1	165	• 7 17.7	−129
16	175 10.7	105 31.8	24.2	61 06.7	36.8	100 40.5	04.9	334 49.3	54.4	349 50.6	166	7 30.6	−128
17	190 13.2	120 31.4	24.6	76 07.5	36.6	115 42.4	05.0	349 51.7	54.4	4 26.2	165	7 43.4	−128
18	205 15.6	135 31.1	+19 25.1	91 08.2	+22 36.3	130 44.4	+22 05.0	4 54.1	− 5 54.5	19 01.7	164	− 7 56.2	−128
19	220 18.1	150 30.7	25.6	106 08.9	36.1	145 46.3	05.1	19 56.4	54.5	33 37.1	164	8 09.0	−127
20	235 20.6	165 30.4	26.0	121 09.6	35.8	160 48.2	05.1	34 58.8	54.5	48 12.5	164	8 21.7	−128
21	250 23.0	180 30.0	•• 26.5	136 10.3	•• 35.6	175 50.1	•• 05.2	50 01.2	•• 54.6	62 47.9	164	• 8 34.5	−127
22	265 25.5	195 29.7	26.9	151 11.1	35.3	190 52.0	05.2	65 03.6	54.6	77 23.3	163	8 47.2	−126
23	280 28.0	210 29.3	27.4	166 11.8	35.1	205 53.9	05.3	80 05.9	54.7	91 58.6	163	8 59.8	−127
24	295 30.4	225 29.0	+19 27.8	181 12.5	+22 34.8	220 55.8	+22 05.3	95 08.3	− 5 54.7	106 33.9	162	− 9 12.5	−126
code	−	− 4	+ 5	+ 7	− 2	+ 19	+ 1	+ 24	0				

GMT	h	SUN GHA ° ′	Dec. ° ′
15	0	178 33.5	+21 36.9
	1	193 33.4	36.5
	2	208 33.3	36.1
	3	223 33.3	35.7
	4	238 33.2	35.3
	5	253 33.1	35.0
	6	268 33.1	+21 34.6
	7	283 33.0	34.2
	8	298 32.9	33.8
	9	313 32.9	33.4
	10	328 32.8	33.0
	11	343 32.7	32.6
	12	358 32.7	+21 32.2
	13	13 32.6	31.8
	14	28 32.5	31.4
	15	43 32.5	31.0
	16	58 32.4	30.6
	17	73 32.3	30.2
	18	88 32.3	+21 29.8
	19	103 32.2	29.4
	20	118 32.1	29.0
	21	133 32.1	28.7
	22	148 32.0	28.3
	23	163 32.0	27.9
16	0	178 31.9	+21 27.5
	1	193 31.8	27.0
	2	208 31.8	26.6
	3	223 31.7	26.2
	4	238 31.6	25.8
	5	253 31.6	25.4
	6	268 31.5	+21 25.0
	7	283 31.5	24.6
	8	298 31.4	24.2
	9	313 31.3	23.8
	10	328 31.3	23.4
	11	343 31.2	23.0
	12	358 31.2	+21 22.6
	13	13 31.1	22.2
	14	28 31.0	21.8
	15	43 31.0	21.4
	16	58 30.9	20.9
	17	73 30.9	20.5
	18	88 30.8	+21 20.1
	19	103 30.7	19.7
	20	118 30.7	19.3
	21	133 30.6	18.9
	22	148 30.6	18.5
	23	163 30.5	18.1
17	0	178 30.5	+21 17.6
	1	193 30.4	17.2
	2	208 30.4	16.8
	3	223 30.3	16.4
	4	238 30.2	16.0
	5	253 30.2	15.5
	6	268 30.1	+21 15.1
	7	283 30.1	14.7
	8	298 30.0	14.3
	9	313 30.0	13.9
	10	328 29.9	13.4
	11	343 29.9	13.0
	12	358 29.8	+21 12.6
	13	13 29.7	12.2
	14	28 29.7	11.7
	15	43 29.6	11.3
	16	58 29.6	10.9
	17	73 29.5	10.5
	18	88 29.5	+21 10.0
	19	103 29.4	09.6
	20	118 29.4	09.2
	21	133 29.3	08.8
	22	148 29.3	08.3
	23	163 29.2	07.9
	24	178 29.2	+21 07.5
	code	—	- 4

No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.5	−40 29.0
5	Achernar	335 59.9	−57 27.9
30	Acrux	174 00.1	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.2	+16 25.2
32	Alioth	166 59.9	+56 12.9
34	Alkaid	153 34.0	+49 32.8
55	Al Na'ir	28 39.5	−47 11.0
15	Alnilam	276 32.3	− 1 13.7
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.3
1	Alpheratz	358 30.0	+28 50.0
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.7	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.4
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.7
16	Betelg'se	271 50.2	+ 7 24.1
17	Canopus	264 16.6	−52 40.0
12	Capella	281 41.3	+45 57.2
53	Deneb	50 01.7	+45 06.8
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.8	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 06.5	+51 29.7
54	Enif	34 31.0	+ 9 39.7
56	Fomalhaut	16 13.1	−29 51.9
31	Gacrux	172 51.4	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.8	−60 09.4
6	Hamal	328 51.6	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.1	+74 20.9
57	Markab	14 22.9	+14 57.4
8	Menkar	315 02.2	+ 3 54.7
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.5	−69 31.7
9	Mirfak	309 45.1	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.1	+ 5 20.8
46	R'alhague	96 47.9	+12 35.5
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.5	− 8 15.1
38	Rigil Kent.	140 53.2	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.9	+56 16.8
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.7	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.2

GMT h	Equation of Time (App.—Mean) 15 m s	16 m s	17 m s
0	− 5 46.0	− 5 52.3	− 5 58.0
6	− 5 47.7	− 5 53.8	− 5 59.4
12	− 5 49.2	− 5 55.2	− 6 00.7
18	− 5 50.8	− 5 56.7	− 6 02.0
24	− 5 52.3	− 5 58.0	− 6 03.2

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 15 h m	16 h m	17 h m	18 h m
72	▭	▭	8 13	10 06	12 00	14 04
70	▭	▭	8 20	10 04	11 49	13 41
68	▭	▭	8 25	10 03	11 41	13 24
66	1 38	////	8 30	10 02	11 34	13 10
64	2 17	////	8 34	10 01	11 29	12 59
62	2 44	////	8 37	10 00	11 24	12 49
60	3 05	////	8 40	10 00	11 19	12 41
58	3 22	////	8 43	9 59	11 16	12 34
56	3 36	////	8 45	9 59	11 12	12 27
54	3 48	////	8 47	9 58	11 09	12 22
52	3 59	////	8 49	9 58	11 07	12 17
50	4 08	0 46	8 51	9 57	11 04	12 12
45	4 28	2 07	8 54	9 57	10 59	12 02
40	4 44	2 46	8 57	9 56	10 55	11 54
35	4 58	3 14	9 00	9 55	10 51	11 47
30	5 09	3 35	9 02	9 55	10 48	11 41
20	5 29	4 07	9 06	9 54	10 42	11 30
10	5 46	4 30	9 10	9 53	10 37	11 21
0	6 02	4 48	9 13	9 53	10 32	11 13
10	6 18	5 04	9 16	9 52	10 28	11 04
20	6 35	5 17	9 20	9 51	10 23	10 55
30	6 54	5 30	9 24	9 50	10 17	10 45
35	7 05	5 37	9 26	9 50	10 14	10 39
40	7 18	5 42	9 29	9 50	10 11	10 33
45	7 33	5 48	9 32	9 49	10 06	10 25
50	7 51	5 55	9 35	9 48	10 02	10 16
52	8 00	5 58	9 37	9 48	9 59	10 12
54	8 09	6 01	9 38	9 48	9 57	10 07
56	8 20	6 04	9 40	9 47	9 54	10 02
58	8 33	6 07	9 43	9 47	9 51	9 57
60	8 47	6 11	9 45	9 47	9 48	9 50

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 15 h m	16 h m	17 h m	18 h m
72	▭	▭	21 53	21 26	20 57	20 18
70	▭	▭	21 51	21 31	21 10	20 43
68	▭	▭	21 49	21 35	21 20	21 02
66	22 30	////	21 48	21 38	21 28	21 17
64	21 52	////	21 46	21 41	21 36	21 30
62	21 26	////	21 45	21 44	21 42	21 41
60	21 06	////	21 44	21 46	21 48	21 50
58	20 49	////	21 43	21 48	21 52	21 58
56	20 35	////	21 43	21 49	21 57	22 05
54	20 23	////	21 42	21 51	22 01	22 12
52	20 13	////	21 41	21 52	22 04	22 18
50	20 03	23 20	21 41	21 54	22 07	22 23
45	19 43	22 02	21 39	21 57	22 15	22 34
40	19 27	21 23	21 38	21 59	22 21	22 44
35	19 14	20 57	21 37	22 01	22 26	22 52
30	19 02	20 35	21 36	22 03	22 30	22 59
20	18 43	20 05	21 35	22 06	22 38	23 12
10	18 25	19 41	21 33	22 09	22 45	23 23
0	18 10	19 24	21 32	22 12	22 51	23 33
10	17 54	19 08	21 31	22 14	22 58	23 44
20	17 37	18 55	21 29	22 17	23 05	23 55
30	17 18	18 42	21 28	22 20	23 13	24 07
35	17 07	18 36	21 27	22 22	23 18	24 15
40	16 54	18 30	21 26	22 24	23 23	24 23
45	16 40	18 25	21 24	22 27	23 29	24 33
50	16 21	18 17	21 23	22 30	23 37	24 45
52	16 13	18 15	21 22	22 31	23 40	24 51
54	16 03	18 12	21 21	22 32	23 44	24 57
56	15 52	18 09	21 20	22 34	23 48	25 04
58	15 40	18 07	21 20	22 36	23 53	25 12
60	15 25	18 03	21 18	22 38	23 58	25 21

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
15	15 23	8 57	11 58	9 24	17 48
16	16 02	8 57	11 57	9 21	17 44
17	16 42	8 58	11 56	9 18	17 41
18	17 23	8 58	11 55	9 15	17 37

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	15 ′	16 ′	17 ′
0	12.1	12.0	12.0
4	12.1	12.0	12.0
8	12.2	12.0	12.0
12	12.2	12.1	12.1
16	12.2	12.1	12.1
20	12.3	12.2	12.2
24	12.4	12.3	12.3
28	12.5	12.4	12.4
32	12.6	12.5	12.5
36	12.7	12.6	12.6
40	12.8	12.7	12.7
44	12.9	12.8	12.8
48	13.1	13.0	13.0
52	13.2	13.1	13.1
56	13.4	13.3	13.3
60	13.5	13.5	13.5
64	13.7	13.6	13.6
68	13.9	13.8	13.8
72	14.1	14.0	14.0
76	14.3	14.2	14.2
80	14.4	14.4	14.4
84	14.6	14.6	14.6
88	14.8	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	15 ′	16 ′	17 ′
0	17.5	17.6	17.6
4	17.5	17.6	17.6
8	17.5	17.5	17.5
12	17.4	17.5	17.5
16	17.4	17.5	17.5
20	17.3	17.4	17.4
24	17.2	17.3	17.3
28	17.2	17.2	17.2
32	17.1	17.1	17.1
36	16.9	17.0	17.0
40	16.8	16.9	16.9
44	16.7	16.7	16.7
48	16.6	16.6	16.6
52	16.4	16.4	16.4
56	16.2	16.3	16.3
60	16.1	16.1	16.1
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.0
88	14.9	14.8	14.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.7 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
18 0	295 30.4	225 29.0	+19 27.8	181 12.5	+22 34.8	220 55.8	+22 05.3	95 08.3	− 5 54.7	106 33.9	162	− 9 12.5	−126
1	310 32.9	240 28.6	28.3	196 13.2	34.6	235 57.8	05.4	110 10.7	54.8	121 09.1	162	9 25.1	−125
2	325 35.3	255 28.3	28.7	211 13.9	34.3	250 59.7	05.5	125 13.1	54.8	135 44.3	161	9 37.6	−126
3	340 37.8	270 27.9	•• 29.2	226 14.7	•• 34.0	266 01.6	•• 05.5	140 15.4	•• 54.9	150 19.4	161	• 9 50.2	−125
4	355 40.3	285 27.6	29.6	241 15.4	33.8	281 03.5	05.6	155 17.8	54.9	164 54.5	161	10 02.7	−125
5	10 42.7	300 27.2	30.1	256 16.1	33.5	296 05.4	05.6	170 20.2	55.0	179 29.6	160	10 15.2	−124
6	25 45.2	315 26.9	+19 30.5	271 16.8	+22 33.3	311 07.3	+22 05.7	185 22.6	− 5 55.0	194 04.6	160	−10 27.6	−124
7	40 47.7	330 26.5	31.0	286 17.6	33.0	326 09.2	05.7	200 24.9	55.1	208 39.6	159	10 40.0	−124
8	55 50.1	345 26.1	31.4	301 18.3	32.8	341 11.2	05.8	215 27.3	55.1	223 14.5	159	10 52.4	−123
9	70 52.6	0 25.8	•• 31.9	316 19.0	•• 32.5	356 13.1	•• 05.8	230 29.7	•• 55.2	237 49.4	158	•11 04.7	−123
10	85 55.1	15 25.4	32.3	331 19.7	32.3	11 15.0	05.9	245 32.1	55.2	252 24.2	158	11 17.0	−123
11	100 57.5	30 25.1	32.8	346 20.4	32.0	26 16.9	05.9	260 34.4	55.2	266 59.0	157	11 29.3	−122
12	116 00.0	45 24.7	+19 33.2	1 21.2	+22 31.7	41 18.8	+22 06.0	275 36.8	− 5 55.3	281 33.7	156	−11 41.5	−122
13	131 02.5	60 24.3	33.7	16 21.9	31.5	56 20.7	06.1	290 39.2	55.3	296 08.3	157	11 53.7	−121
14	146 04.9	75 24.0	34.1	31 22.6	31.2	71 22.7	06.1	305 41.6	55.4	310 43.0	155	12 05.8	−121
15	161 07.4	90 23.6	•• 34.5	46 23.3	•• 31.0	86 24.6	•• 06.2	320 43.9	•• 55.4	325 17.5	155	•12 17.9	−121
16	176 09.8	105 23.3	35.0	61 24.1	30.7	101 26.5	06.2	335 46.3	55.5	339 52.0	154	12 30.0	−120
17	191 12.3	120 22.9	35.4	76 24.8	30.4	116 28.4	06.3	350 48.7	55.5	354 26.4	154	12 42.0	−120
18	206 14.8	135 22.5	+19 35.9	91 25.5	+22 30.2	131 30.3	+22 06.3	5 51.1	− 5 55.6	9 00.8	153	−12 54.0	−120
19	221 17.2	150 22.2	36.3	106 26.2	29.9	146 32.2	06.4	20 53.4	55.6	23 35.1	153	13 06.0	−118
20	236 19.7	165 21.8	36.7	121 27.0	29.7	161 34.2	06.4	35 55.8	55.7	38 09.4	152	13 17.8	−119
21	251 22.2	180 21.4	•• 37.2	136 27.7	•• 29.4	176 36.1	•• 06.5	50 58.2	•• 55.7	52 43.6	151	•13 29.7	−118
22	266 24.6	195 21.1	37.6	151 28.4	29.1	191 38.0	06.5	66 00.6	55.8	67 17.7	151	13 41.5	−117
23	281 27.1	210 20.7	38.1	166 29.1	28.9	206 39.9	06.6	81 02.9	55.8	81 51.8	150	13 53.2	−117
19 0	296 29.6	225 20.3	+19 38.5	181 29.9	+22 28.6	221 41.8	+22 06.7	96 05.3	− 5 55.9	96 25.8	150	−14 04.9	−117
1	311 32.0	240 20.0	38.9	196 30.6	28.3	236 43.7	06.7	111 07.7	55.9	110 59.8	148	14 16.6	−116
2	326 34.5	255 19.6	39.4	211 31.3	28.1	251 45.7	06.8	126 10.1	56.0	125 33.6	149	14 28.2	−116
3	341 37.0	270 19.2	•• 39.8	226 32.0	•• 27.8	266 47.6	•• 06.8	141 12.4	•• 56.0	140 07.5	147	•14 39.8	−115
4	356 39.4	285 18.9	40.2	241 32.8	27.6	281 49.5	06.9	156 14.8	56.1	154 41.2	147	14 51.3	−114
5	11 41.9	300 18.5	40.7	256 33.5	27.3	296 51.4	06.9	171 17.2	56.1	169 14.9	146	15 02.7	−114
6	26 44.3	315 18.1	+19 41.1	271 34.2	+22 27.0	311 53.3	+22 07.0	186 19.5	− 5 56.2	183 48.5	145	−15 14.1	−114
7	41 46.8	330 17.8	41.5	286 34.9	26.8	326 55.3	07.0	201 21.9	56.2	198 22.0	145	15 25.5	−112
8	56 49.3	345 17.4	42.0	301 35.7	26.5	341 57.2	07.1	216 24.3	56.3	212 55.5	143	15 36.7	−113
9	71 51.7	0 17.0	•• 42.4	316 36.4	•• 26.2	356 59.1	•• 07.1	231 26.7	•• 56.3	227 28.8	144	•15 48.0	−112
10	86 54.2	15 16.6	42.8	331 37.1	26.0	12 01.0	07.2	246 29.0	56.4	242 02.2	142	15 59.2	−111
11	101 56.7	30 16.3	43.3	346 37.8	25.7	27 02.9	07.3	261 31.4	56.4	256 35.4	142	16 10.3	−110
12	116 59.1	45 15.9	+19 43.7	1 38.6	+22 25.4	42 04.8	+22 07.3	276 33.8	− 5 56.5	271 08.6	140	−16 21.3	−110
13	132 01.6	60 15.5	44.1	16 39.3	25.2	57 06.8	07.4	291 36.1	56.5	285 41.6	140	16 32.3	−110
14	147 04.1	75 15.1	44.6	31 40.0	24.9	72 08.7	07.4	306 38.5	56.5	300 14.6	140	16 43.3	−109
15	162 06.5	90 14.8	•• 45.0	46 40.8	•• 24.6	87 10.6	•• 07.5	321 40.9	•• 56.6	314 47.6	138	•16 54.2	−108
16	177 09.0	105 14.4	45.4	61 41.5	24.4	102 12.5	07.5	336 43.2	56.6	329 20.4	138	17 05.0	−107
17	192 11.4	120 14.0	45.8	76 42.2	24.1	117 14.4	07.6	351 45.6	56.7	343 53.2	137	17 15.7	−107
18	207 13.9	135 13.6	+19 46.3	91 42.9	+22 23.8	132 16.4	+22 07.6	6 48.0	− 5 56.7	358 25.9	136	−17 26.4	−106
19	222 16.4	150 13.3	46.7	106 43.7	23.6	147 18.3	07.7	21 50.4	56.8	12 58.5	135	17 37.0	−106
20	237 18.8	165 12.9	47.1	121 44.4	23.3	162 20.2	07.7	36 52.7	56.8	27 31.0	134	17 47.6	−105
21	252 21.3	180 12.5	•• 47.5	136 45.1	•• 23.0	177 22.1	•• 07.8	51 55.1	•• 56.9	42 03.4	134	•17 58.1	−104
22	267 23.8	195 12.1	48.0	151 45.9	22.8	192 24.0	07.8	66 57.5	56.9	56 35.8	133	18 08.5	−103
23	282 26.2	210 11.7	48.4	166 46.6	22.5	207 26.0	07.9	81 59.8	57.0	71 08.1	131	18 18.8	−103
20 0	297 28.7	225 11.4	+19 48.8	181 47.3	+22 22.2	222 27.9	+22 07.9	97 02.2	− 5 57.0	85 40.2	131	−18 29.1	−102
1	312 31.2	240 11.0	49.2	196 48.0	22.0	237 29.8	08.0	112 04.6	57.1	100 12.3	130	18 39.3	−102
2	327 33.6	255 10.6	49.6	211 48.8	21.7	252 31.7	08.1	127 06.9	57.1	114 44.3	130	18 49.5	−100
3	342 36.1	270 10.2	•• 50.1	226 49.5	•• 21.4	267 33.6	•• 08.1	142 09.3	•• 57.2	129 16.3	128	•18 59.5	−100
4	357 38.6	285 09.8	50.5	241 50.2	21.2	282 35.6	08.2	157 11.7	57.2	143 48.1	127	19 09.5	− 99
5	12 41.0	300 09.4	50.9	256 51.0	20.9	297 37.5	08.2	172 14.0	57.3	158 19.8	127	19 19.4	− 99
6	27 43.5	315 09.1	+19 51.3	271 51.7	+22 20.6	312 39.4	+22 08.3	187 16.4	− 5 57.3	172 51.5	125	−19 29.3	− 97
7	42 45.9	330 08.7	51.7	286 52.4	20.3	327 41.3	08.3	202 18.8	57.4	187 23.0	125	19 39.0	− 97
8	57 48.4	345 08.3	52.1	301 53.2	20.1	342 43.2	08.4	217 21.2	57.4	201 54.5	124	19 48.7	− 96
9	72 50.9	0 07.9	•• 52.6	316 53.9	•• 19.8	357 45.2	•• 08.4	232 23.5	•• 57.5	216 25.9	123	•19 58.3	− 95
10	87 53.3	15 07.5	53.0	331 54.6	19.5	12 47.1	08.5	247 25.9	57.5	230 57.2	122	20 07.8	− 95
11	102 55.8	30 07.1	53.4	346 55.3	19.3	27 49.0	08.5	262 28.3	57.6	245 28.4	121	20 17.3	− 93
12	117 58.3	45 06.7	+19 53.8	1 56.1	+22 19.0	42 50.9	+22 08.6	277 30.6	− 5 57.6	259 59.5	120	−20 26.6	− 93
13	133 00.7	60 06.3	54.2	16 56.8	18.7	57 52.9	08.6	292 33.0	57.7	274 30.5	119	20 35.9	− 92
14	148 03.2	75 06.0	54.6	31 57.5	18.4	72 54.8	08.7	307 35.4	57.7	289 01.4	118	20 45.1	− 90
15	163 05.7	90 05.6	•• 55.0	46 58.3	•• 18.2	87 56.7	•• 08.7	322 37.7	•• 57.8	303 32.2	117	•20 54.1	− 90
16	178 08.1	105 05.2	55.5	61 59.0	17.9	102 58.6	08.8	337 40.1	57.8	318 02.9	116	21 03.1	− 90
17	193 10.6	120 04.8	55.9	76 59.7	17.6	118 00.5	08.8	352 42.5	57.9	332 33.5	115	21 12.1	− 88
18	208 13.1	135 04.4	+19 56.3	92 00.5	+22 17.3	133 02.5	+22 08.9	7 44.8	− 5 57.9	347 04.0	115	−21 20.9	− 87
19	223 15.5	150 04.0	56.7	107 01.2	17.1	148 04.4	09.0	22 47.2	58.0	1 34.5	113	21 29.6	− 87
20	238 18.0	165 03.6	57.1	122 01.9	16.8	163 06.3	09.0	37 49.6	58.0	16 04.8	112	21 38.3	− 85
21	253 20.4	180 03.2	•• 57.5	137 02.7	•• 16.5	178 08.2	•• 09.1	52 51.9	•• 58.1	30 35.0	112	•21 46.8	− 85
22	268 22.9	195 02.8	57.9	152 03.4	16.2	193 10.2	09.1	67 54.3	58.1	45 05.2	110	21 55.3	− 83
23	283 25.4	210 02.4	58.3	167 04.1	16.0	208 12.1	09.2	82 56.7	58.2	59 35.2	109	22 03.6	− 83
24	298 27.8	225 02.0	+19 58.7	182 04.9	+22 15.7	223 14.0	+22 09.2	97 59.0	− 5 58.2	74 05.1	109	−22 11.9	− 81
code	−	− 4	+ 4	+ 7	− 2	+ 20	+ 1	+ 23	0				

GMT	SUN GHA	SUN Dec.
18 h 0	178 29.2	+21 07.5
1	193 29.1	07.0
2	208 29.1	06.6
3	223 29.0	06.2
4	238 29.0	05.7
5	253 28.9	05.3
6	268 28.9	+21 04.9
7	283 28.8	04.4
8	298 28.8	04.0
9	313 28.7	03.6
10	328 28.7	03.1
11	343 28.6	02.7
12	358 28.6	+21 02.2
13	13 28.5	01.8
14	28 28.5	01.4
15	43 28.4	00.9
16	58 28.4	00.5
17	73 28.3	21 00.0
18	88 28.3	+20 59.6
19	103 28.2	59.2
20	118 28.2	58.7
21	133 28.1	58.3
22	148 28.1	57.8
23	163 28.1	57.4
19 0	178 28.0	+20 56.9
1	193 28.0	56.5
2	208 27.9	56.0
3	223 27.9	55.6
4	238 27.8	55.1
5	253 27.8	54.7
6	268 27.7	+20 54.3
7	283 27.7	53.8
8	298 27.7	53.3
9	313 27.6	52.9
10	328 27.6	52.4
11	343 27.5	52.0
12	358 27.5	+20 51.5
13	13 27.4	51.1
14	28 27.4	50.6
15	43 27.4	50.2
16	58 27.3	49.7
17	73 27.3	49.3
18	88 27.2	+20 48.8
19	103 27.2	48.4
20	118 27.1	47.9
21	133 27.1	47.4
22	148 27.1	47.0
23	163 27.0	46.5
20 0	178 27.0	+20 46.1
1	193 26.9	45.6
2	208 26.9	45.1
3	223 26.9	44.7
4	238 26.8	44.2
5	253 26.8	43.7
6	268 26.8	+20 43.3
7	283 26.7	42.8
8	298 26.7	42.4
9	313 26.6	41.9
10	328 26.6	41.4
11	343 26.6	41.0
12	358 26.5	+20 40.5
13	13 26.5	40.0
14	28 26.5	39.5
15	43 26.4	39.1
16	58 26.4	38.6
17	73 26.3	38.1
18	88 26.3	+20 37.7
19	103 26.3	37.2
20	118 26.2	36.7
21	133 26.2	36.2
22	148 26.2	35.8
23	163 26.1	35.3
24	178 26.1	+20 34.8
code	—	- 4

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.4	−40 29.0
5	Achernar	335 59.9	−57 27.9
30	Acrux	174 00.1	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.2	+16 25.2
32	Alioth	167 00.0	+56 12.9
34	Alkaid	153 34.1	+49 32.8
55	Al Na'ir	28 39.5	−47 11.0
15	Alnilam	276 32.2	− 1 13.6
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.3
1	Alpheratz	358 29.9	+28 50.1
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.7	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.5
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.7
16	Betelg'se	271 50.2	+ 7 24.1
17	Canopus	264 16.6	−52 40.0
12	Capella	281 41.3	+45 57.2
53	Deneb	50 01.7	+45 06.8
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.8	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.8	+28 34.3
47	Eltanin	91 06.5	+51 29.7
54	Enif	34 30.9	+ 9 39.7
56	Fomalhaut	16 13.1	−29 51.9
31	Gacrux	172 51.4	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.9	−60 09.4
6	Hamal	328 51.6	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.2	+74 20.9
57	Markab	14 22.9	+14 57.4
8	Menkar	315 02.2	+ 3 54.7
36	Menkent	149 00.6	−36 08.8
24	Miapl'dus	221 50.5	−69 31.7
9	Mirfak	309 45.0	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 23.0	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.5	− 8 15.0
38	Rigil Kent.	140 53.2	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.9	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.2

GMT	Equation of Time (App.—Mean) 18	19	20
h	m s	m s	m s
0	− 6 03.2	− 6 07.9	− 6 12.0
6	− 6 04.5	− 6 09.0	− 6 12.9
12	− 6 05.6	− 6 10.0	− 6 13.8
18	− 6 06.8	− 6 11.0	− 6 14.7
24	− 6 07.9	− 6 12.0	− 6 15.5

Lat.	Sunrise	Twlt. begins	Moonrise 18	19	20	21
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	14 04	17 01	■	■
70	▭	▭	13 41	15 55	■	■
68	0 42	////	13 24	15 19	17 57	■
66	1 51	////	13 10	14 54	16 54	■
64	2 26	////	12 59	14 35	16 19	18 19
62	2 51	////	12 49	14 19	15 55	17 35
60	3 11	////	12 41	14 06	15 35	17 06
58	3 27	////	12 34	13 55	15 19	16 44
56	3 40	////	12 27	13 45	15 05	16 26
54	3 52	////	12 22	13 36	14 53	16 11
52	4 03	////	12 17	13 29	14 43	15 58
50	4 12	1 01	12 12	13 22	14 34	15 46
45	4 31	2 12	12 02	13 07	14 14	15 22
40	4 47	2 50	11 54	12 55	13 59	15 03
35	5 00	3 17	11 47	12 45	13 45	14 48
30	5 11	3 37	11 41	12 36	13 34	14 34
20	5 30	4 08	11 30	12 21	13 15	14 11
10	5 47	4 31	11 21	12 08	12 58	13 51
0	6 03	4 49	11 13	11 56	12 42	13 32
10	6 18	5 04	11 04	11 44	12 26	13 13
20	6 34	5 17	10 55	11 31	12 10	12 54
30	6 53	5 29	10 45	11 16	11 51	12 31
35	7 04	5 35	10 39	11 07	11 40	12 18
40	7 16	5 41	10 33	10 58	11 27	12 03
45	7 30	5 47	10 25	10 47	11 12	11 44
50	7 48	5 53	10 16	10 33	10 54	11 22
52	7 56	5 56	10 12	10 27	10 46	11 12
54	8 06	5 58	10 07	10 20	10 36	11 00
56	8 16	6 02	10 02	10 12	10 26	10 46
58	8 28	6 04	9 57	10 04	10 14	10 30
60 S	8 42	6 07	9 50	9 54	10 00	10 11

Lat.	Sunset	Twlt. ends	Moonset 18	19	20	21
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	20 18	18 52	■	■
70	▭	▭	20 43	20 00	■	■
68	23 20	////	21 02	20 37	19 36	■
66	22 18	////	21 17	21 03	20 40	■
64	21 44	////	21 30	21 24	21 16	21 02
62	21 19	////	21 41	21 40	21 41	21 46
60	21 00	////	21 50	21 54	22 02	22 16
58	20 44	////	21 58	22 06	22 18	22 38
56	20 31	////	22 05	22 17	22 33	22 57
54	20 19	////	22 12	22 26	22 45	23 12
52	20 09	////	22 18	22 34	22 56	23 26
50	20 00	23 06	22 23	22 42	23 05	23 37
45	19 41	21 58	22 34	22 57	23 26	24 02
40	19 25	21 20	22 44	23 11	23 43	24 22
35	19 12	20 54	22 52	23 22	23 57	24 38
30	19 01	20 34	22 59	23 32	24 09	0 09
20	18 42	20 04	23 12	23 49	24 30	0 30
10	18 25	19 41	23 23	24 03	0 03	0 48
0	18 10	19 24	23 33	24 17	0 17	1 05
10	17 55	19 09	23 44	24 31	0 31	1 23
20	17 38	18 55	23 55	24 46	0 46	1 41
30	17 20	18 44	24 07	0 07	1 04	2 03
35	17 09	18 38	24 15	0 15	1 14	2 15
40	16 57	18 32	24 23	0 23	1 26	2 30
45	16 42	18 26	24 33	0 33	1 39	2 47
50	16 25	18 21	24 45	0 45	1 56	3 08
52	16 17	18 18	24 51	0 51	2 04	3 19
54	16 07	18 15	24 57	0 57	2 13	3 30
56	15 57	18 13	25 04	1 04	2 23	3 43
58	15 45	18 10	25 12	1 12	2 34	3 59
60 S	15 31	18 07	25 21	1 21	2 47	4 17

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
18	17 23	8 58	11 55	9 15	17 37
19	18 07	8 59	11 53	9 12	17 33
20	18 54	9 00	11 52	9 09	17 29
21	19 45	9 00	11 51	9 06	17 25

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	18	19	20
°	′	′	′
0	12.2	12.8	13.5
4	12.3	12.8	13.5
8	12.3	12.8	13.5
12	12.3	12.8	13.6
16	12.4	12.9	13.6
20	12.4	12.9	13.6
24	12.5	13.0	13.7
28	12.6	13.0	13.7
32	12.7	13.1	13.8
36	12.8	13.2	13.9
40	12.9	13.3	13.9
44	13.0	13.4	14.0
48	13.2	13.5	14.1
52	13.3	13.7	14.2
56	13.5	13.8	14.3
60	13.6	13.9	14.4
64	13.8	14.1	14.5
68	14.0	14.2	14.6
72	14.1	14.3	14.7
76	14.3	14.5	14.8
80	14.5	14.6	14.9
84	14.7	14.8	15.0
88	14.8	14.9	15.1
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	18	19	20
°	′	′	′
0	17.4	17.2	16.7
4	17.4	17.1	16.7
8	17.4	17.1	16.7
12	17.4	17.1	16.7
16	17.3	17.0	16.6
20	17.3	17.0	16.6
24	17.2	16.9	16.6
28	17.1	16.9	16.5
32	17.0	16.8	16.4
36	16.9	16.7	16.4
40	16.8	16.6	16.3
44	16.6	16.5	16.2
48	16.5	16.4	16.1
52	16.4	16.2	16.1
56	16.2	16.1	16.0
60	16.1	16.0	15.9
64	15.9	15.8	15.8
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.3	15.3
84	15.0	15.1	15.2
88	14.9	15.0	15.1
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.7 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
21 0	298 27.8	225 02.0	+19 58.7	182 04.9	+22 15.7	223 14.0	+22 09.2	97 59.0	− 5 58.2	74 05.1	109	−22 11.9	− 81
1	313 30.3	240 01.6	59.1	197 05.6	15.4	238 15.9	09.3	113 01.4	58.3	88 35.0	107	22 20.0	− 81
2	328 32.8	255 01.2	59.5	212 06.3	15.1	253 17.8	09.3	128 03.8	58.3	103 04.7	106	22 28.1	− 79
3	343 35.2	270 00.8	·19 59.9	227 07.1	·· 14.9	268 19.8	·· 09.4	143 06.1	·· 58.4	117 34.3	106	·22 36.0	− 79
4	358 37.7	285 00.4	20 00.3	242 07.8	14.6	283 21.7	09.4	158 08.5	58.4	132 03.9	104	22 43.9	− 77
5	13 40.2	300 00.0	00.7	257 08.5	14.3	298 23.6	09.5	173 10.8	58.5	146 33.3	103	22 51.6	− 77
6	28 42.6	314 59.6	+20 01.1	272 09.3	+22 14.0	313 25.5	+22 09.5	188 13.2	− 5 58.5	161 02.6	103	−22 59.3	− 75
7	43 45.1	329 59.2	01.5	287 10.0	13.8	328 27.5	09.6	203 15.6	58.6	175 31.9	101	23 06.8	− 74
8	58 47.6	344 58.8	01.9	302 10.7	13.5	343 29.4	09.6	218 17.9	58.6	190 01.0	100	23 14.2	− 74
9	73 50.0	359 58.4	·· 02.3	317 11.5	·· 13.2	358 31.3	·· 09.7	233 20.3	·· 58.7	204 30.0	100	·23 21.6	− 72
10	88 52.5	14 58.0	02.7	332 12.2	12.9	13 33.2	09.7	248 22.7	58.7	218 59.0	98	23 28.8	− 71
11	103 54.9	29 57.6	03.1	347 12.9	12.6	28 35.2	09.8	263 25.0	58.8	233 27.8	98	23 35.9	− 70
12	118 57.4	44 57.2	+20 03.5	2 13.7	+22 12.4	43 37.1	+22 09.8	278 27.4	− 5 58.8	247 56.6	96	−23 42.9	− 68
13	133 59.9	59 56.8	03.9	17 14.4	12.1	58 39.0	09.9	293 29.8	58.9	262 25.2	95	23 49.7	− 68
14	149 02.3	74 56.4	04.3	32 15.1	11.8	73 40.9	09.9	308 32.1	59.0	276 53.7	95	23 56.5	− 66
15	164 04.8	89 56.0	·· 04.7	47 15.9	·· 11.5	88 42.9	·· 10.0	323 34.5	·· 59.0	291 22.2	93	·24 03.1	− 65
16	179 07.3	104 55.6	05.1	62 16.6	11.2	103 44.8	10.0	338 36.9	59.1	305 50.5	92	24 09.6	− 64
17	194 09.7	119 55.2	05.5	77 17.3	11.0	118 46.7	10.1	353 39.2	59.1	320 18.7	92	24 16.0	− 63
18	209 12.2	134 54.8	+20 05.9	92 18.1	+22 10.7	133 48.6	+22 10.1	8 41.6	− 5 59.2	334 46.9	90	−24 22.3	− 62
19	224 14.7	149 54.4	06.3	107 18.8	10.4	148 50.6	10.2	23 43.9	59.2	349 14.9	90	24 28.5	− 60
20	239 17.1	164 54.0	06.7	122 19.6	10.1	163 52.5	10.2	38 46.3	59.3	3 42.9	88	24 34.5	− 59
21	254 19.6	179 53.6	·· 07.1	137 20.3	·· 09.8	178 54.4	·· 10.3	53 48.7	·· 59.3	18 10.7	87	·24 40.4	− 58
22	269 22.0	194 53.2	07.5	152 21.0	09.6	193 56.3	10.4	68 51.0	59.4	32 38.4	87	24 46.2	− 57
23	284 24.5	209 52.8	07.8	167 21.8	09.3	208 58.3	10.4	83 53.4	59.4	47 06.1	85	24 51.9	− 55
22 0	299 27.0	224 52.4	+20 08.2	182 22.5	+22 09.0	224 00.2	+22 10.5	98 55.8	− 5 59.5	61 33.6	85	−24 57.4	− 54
1	314 29.4	239 51.9	08.6	197 23.2	08.7	239 02.1	10.5	113 58.1	59.5	76 01.1	84	25 02.8	− 53
2	329 31.9	254 51.5	09.0	212 24.0	08.4	254 04.0	10.6	129 00.5	59.6	90 28.5	82	25 08.1	− 52
3	344 34.4	269 51.1	·· 09.4	227 24.7	·· 08.1	269 06.0	·· 10.6	144 02.8	·· 59.6	104 55.7	82	·25 13.3	− 50
4	359 36.8	284 50.7	09.8	242 25.4	07.9	284 07.9	10.7	159 05.2	59.7	119 22.9	81	25 18.3	− 48
5	14 39.3	299 50.3	10.2	257 26.2	07.6	299 09.8	10.7	174 07.6	59.7	133 50.0	80	25 23.1	− 48
6	29 41.8	314 49.9	+20 10.5	272 26.9	+22 07.3	314 11.8	+22 10.8	189 09.9	− 5 59.8	148 17.0	79	−25 27.9	− 46
7	44 44.2	329 49.5	10.9	287 27.7	07.0	329 13.7	10.8	204 12.3	59.8	162 43.9	78	25 32.5	− 44
8	59 46.7	344 49.1	11.3	302 28.4	06.7	344 15.6	10.9	219 14.6	59.9	177 10.7	77	25 36.9	− 44
9	74 49.2	359 48.6	·· 11.7	317 29.1	·· 06.4	359 17.5	·· 10.9	234 17.0	· 5 59.9	191 37.4	76	·25 41.3	− 42
10	89 51.6	14 48.2	12.1	332 29.9	06.1	14 19.5	11.0	249 19.4	6 00.0	206 04.0	76	25 45.5	− 40
11	104 54.1	29 47.8	12.5	347 30.6	05.9	29 21.4	11.0	264 21.7	00.0	220 30.6	74	25 49.5	− 39
12	119 56.5	44 47.4	+20 12.8	2 31.4	+22 05.6	44 23.3	+22 11.1	279 24.1	− 6 00.1	234 57.0	74	−25 53.4	− 38
13	134 59.0	59 47.0	13.2	17 32.1	05.3	59 25.3	11.1	294 26.5	00.2	249 23.4	73	25 57.2	− 36
14	150 01.5	74 46.6	13.6	32 32.8	05.0	74 27.2	11.2	309 28.8	00.2	263 49.7	71	26 00.8	− 35
15	165 03.9	89 46.1	·· 14.0	47 33.6	·· 04.7	89 29.1	·· 11.2	324 31.2	·· 00.3	278 15.8	72	·26 04.3	− 33
16	180 06.4	104 45.7	14.3	62 34.3	04.4	104 31.0	11.3	339 33.5	00.3	292 42.0	70	26 07.6	− 32
17	195 08.9	119 45.3	14.7	77 35.1	04.1	119 33.0	11.3	354 35.9	00.4	307 08.0	69	26 10.8	− 30
18	210 11.3	134 44.9	+20 15.1	92 35.8	+22 03.8	134 34.9	+22 11.4	9 38.2	− 6 00.4	321 33.9	69	−26 13.8	− 29
19	225 13.8	149 44.5	15.5	107 36.5	03.6	149 36.8	11.4	24 40.6	00.5	335 59.8	68	26 16.7	− 27
20	240 16.3	164 44.0	15.9	122 37.3	03.3	164 38.7	11.5	39 43.0	00.5	350 25.6	67	26 19.4	− 26
21	255 18.7	179 43.6	·· 16.2	137 38.0	·· 03.0	179 40.7	·· 11.5	54 45.3	·· 00.6	4 51.3	67	·26 22.0	− 24
22	270 21.2	194 43.2	16.6	152 38.8	02.7	194 42.6	11.6	69 47.7	00.6	19 17.0	65	26 24.4	− 22
23	285 23.7	209 42.8	17.0	167 39.5	02.4	209 44.5	11.6	84 50.0	00.7	33 42.5	65	26 26.6	− 21
23 0	300 26.1	224 42.4	+20 17.3	182 40.2	+22 02.1	224 46.5	+22 11.7	99 52.4	− 6 00.7	48 08.0	65	−26 28.7	− 20
1	315 28.6	239 41.9	17.7	197 41.0	01.8	239 48.4	11.7	114 54.8	00.8	62 33.5	63	26 30.7	− 18
2	330 31.0	254 41.5	18.1	212 41.7	01.5	254 50.3	11.8	129 57.1	00.8	76 58.8	63	26 32.5	− 16
3	345 33.5	269 41.1	·· 18.4	227 42.5	·· 01.2	269 52.3	·· 11.8	144 59.5	·· 00.9	91 24.1	62	·26 34.1	− 15
4	0 36.0	284 40.7	18.8	242 43.2	01.0	284 54.2	11.9	160 01.8	00.9	105 49.3	62	26 35.6	− 13
5	15 38.4	299 40.2	19.2	257 43.9	00.7	299 56.1	11.9	175 04.2	01.0	120 14.5	61	26 36.9	− 12
6	30 40.9	314 39.8	+20 19.6	272 44.7	+22 00.4	314 58.0	+22 12.0	190 06.6	− 6 01.1	134 39.6	60	−26 38.1	− 10
7	45 43.4	329 39.4	19.9	287 45.4	22 00.1	330 00.0	12.0	205 08.9	01.1	149 04.6	60	26 39.1	− 8
8	60 45.8	344 39.0	20.3	302 46.2	21 59.8	345 01.9	12.1	220 11.3	01.2	163 29.6	59	26 39.9	− 7
9	75 48.3	359 38.5	·· 20.6	317 46.9	·· 59.5	0 03.8	·· 12.1	235 13.6	·· 01.2	177 54.5	58	·26 40.6	− 5
10	90 50.8	14 38.1	21.0	332 47.7	59.2	15 05.8	12.2	250 16.0	01.3	192 19.3	58	26 41.1	− 3
11	105 53.2	29 37.7	21.4	347 48.4	58.9	30 07.7	12.2	265 18.3	01.3	206 44.1	58	26 41.4	− 2
12	120 55.7	44 37.2	+20 21.7	2 49.1	+21 58.6	45 09.6	+22 12.3	280 20.7	− 6 01.4	221 08.9	57	−26 41.6	0
13	135 58.2	59 36.8	22.1	17 49.9	58.3	60 11.6	12.3	295 23.1	01.4	235 33.6	56	26 41.6	+ 1
14	151 00.6	74 36.4	22.5	32 50.6	58.0	75 13.5	12.4	310 25.4	01.5	249 58.2	56	26 41.5	+ 4
15	166 03.1	89 35.9	·· 22.8	47 51.4	·· 57.7	90 15.4	·· 12.4	325 27.8	·· 01.5	264 22.8	56	·26 41.1	+ 5
16	181 05.5	104 35.5	23.2	62 52.1	57.4	105 17.4	12.5	340 30.1	01.6	278 47.4	55	26 40.6	+ 6
17	196 08.0	119 35.1	23.5	77 52.9	57.2	120 19.3	12.5	355 32.5	01.6	293 11.9	55	26 40.0	+ 8
18	211 10.5	134 34.7	+20 23.9	92 53.6	+21 56.9	135 21.2	+22 12.6	10 34.8	− 6 01.7	307 36.4	54	−26 39.2	+ 10
19	226 12.9	149 34.2	24.3	107 54.3	56.6	150 23.1	12.6	25 37.2	01.8	322 00.8	54	26 38.2	+ 12
20	241 15.4	164 33.8	24.6	122 55.1	56.3	165 25.1	12.7	40 39.5	01.8	336 25.2	54	26 37.0	+ 14
21	256 17.9	179 33.3	·· 25.0	137 55.8	·· 56.0	180 27.0	·· 12.7	55 41.9	·· 01.9	350 49.6	53	·26 35.6	+ 15
22	271 20.3	194 32.9	25.3	152 56.6	55.7	195 28.9	12.8	70 44.3	01.9	5 13.9	53	26 34.1	+ 17
23	286 22.8	209 32.5	25.7	167 57.3	55.4	210 30.9	12.8	85 46.6	02.0	19 38.2	52	26 32.4	+ 18
24	301 25.3	224 32.0	+20 26.0	182 58.1	+21 55.1	225 32.8	+22 12.9	100 49.0	− 6 02.0	34 02.4	53	−26 30.6	+ 20
code	−	− 4	+ 4	+ 7	− 3	+ 20	0	+ 24	− 1				

GMT	SUN GHA	SUN Dec.
21 h 0	178 26.1	+20 34.8
1	193 26.1	34.4
2	208 26.0	33.9
3	223 26.0	33.4
4	238 26.0	32.9
5	253 25.9	32.4
6	268 25.9	+20 32.0
7	283 25.9	31.5
8	298 25.8	31.0
9	313 25.8	30.5
10	328 25.8	30.0
11	343 25.8	29.6
12	358 25.7	+20 29.1
13	13 25.7	28.6
14	28 25.7	28.1
15	43 25.6	27.6
16	58 25.6	27.1
17	73 25.6	26.7
18	88 25.5	+20 26.2
19	103 25.5	25.7
20	118 25.5	25.2
21	133 25.5	24.7
22	148 25.4	24.2
23	163 25.4	23.7
22 0	178 25.4	+20 23.3
1	193 25.3	22.8
2	208 25.3	22.3
3	223 25.3	21.8
4	238 25.3	21.3
5	253 25.2	20.8
6	268 25.2	+20 20.3
7	283 25.2	19.8
8	298 25.2	19.3
9	313 25.1	18.8
10	328 25.1	18.3
11	343 25.1	17.8
12	358 25.1	+20 17.3
13	13 25.0	16.8
14	28 25.0	16.3
15	43 25.0	15.8
16	58 25.0	15.3
17	73 24.9	14.8
18	88 24.9	+20 14.3
19	103 24.9	13.8
20	118 24.9	13.3
21	133 24.8	12.8
22	148 24.8	12.3
23	163 24.8	11.8
23 0	178 24.8	+20 11.3
1	193 24.8	10.8
2	208 24.7	10.3
3	223 24.7	09.8
4	238 24.7	09.3
5	253 24.7	08.8
6	268 24.7	+20 08.3
7	283 24.6	07.8
8	298 24.6	07.3
9	313 24.6	06.8
10	328 24.6	06.3
11	343 24.6	05.8
12	358 24.5	+20 05.3
13	13 24.5	04.7
14	28 24.5	04.2
15	43 24.5	03.7
16	58 24.5	03.2
17	73 24.5	02.7
18	88 24.4	+20 02.2
19	103 24.4	01.7
20	118 24.4	01.2
21	133 24.4	00.6
22	148 24.4	20 00.1
23	163 24.4	19 59.6
24	178 24.3	+19 59.1
code	—	- 5

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.4	−40 29.0
5	Achernar	335 59.9	−57 27.9
30	Acrux	174 00.1	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.2	+16 25.2
32	Alioth	167 00.0	+56 12.9
34	Alkaid	153 34.1	+49 32.8
55	Al Na'ir	28 39.5	−47 11.0
15	Alnilam	276 32.2	− 1 13.6
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.3
1	Alpheratz	358 29.9	+28 50.1
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.6	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.5
43	Atria	109 03.0	−68 57.0
22	Avior	234 37.2	−59 21.6
13	Bellatrix	279 20.5	+ 6 18.7
16	Betelg'se	271 50.2	+ 7 24.1
17	Canopus	264 16.6	−52 40.0
12	Capella	281 41.2	+45 57.2
53	Deneb	50 01.7	+45 06.8
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.8	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 06.5	+51 29.7
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.1	−29 51.9
31	Gacrux	172 51.4	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.9	−60 09.4
6	Hamal	328 51.6	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.2	+74 20.9
57	Markab	14 22.9	+14 57.4
8	Menkar	315 02.1	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 45.0	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.5	− 8 15.0
38	Rigil Kent.	140 53.3	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.8	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.1

GMT	Equation of Time (App.—Mean) 21	22	23
h	m s	m s	m s
0	− 6 15.5	− 6 18.5	− 6 20.8
6	− 6 16.3	− 6 19.1	− 6 21.3
12	− 6 17.1	− 6 19.7	− 6 21.8
18	− 6 17.8	− 6 20.3	− 6 22.2
24	− 6 18.5	− 6 20.8	− 6 22.6

Lat.	Sunrise	Twlt. begins	Moonrise 21	22	23	24
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	■	■	■	■
70	▭	▭	■	■	■	■
68	1 12	////	■	■	■	■
66	2 04	////	■	■	■	■
64	2 35	////	18 19	■	■	21 37
62	2 59	////	17 35	19 13	20 21	20 46
60	3 17	////	17 06	18 32	19 37	20 14
58	3 32	////	16 44	18 04	19 08	19 50
56	3 45	////	16 26	17 42	18 45	19 31
54	3 57	////	16 11	17 24	18 27	19 14
52	4 06	////	15 58	17 09	18 11	19 00
50	4 15	1 14	15 46	16 56	17 58	18 48
45	4 34	2 18	15 22	16 29	17 30	18 22
40	4 49	2 54	15 03	16 08	17 08	18 02
35	5 02	3 20	14 48	15 50	16 50	17 45
30	5 13	3 40	14 34	15 35	16 34	17 30
20	5 32	4 10	14 11	15 09	16 08	17 06
10	5 48	4 32	13 51	14 47	15 45	16 44
0	6 03	4 50	13 32	14 26	15 24	16 24
10	6 18	5 04	13 13	14 06	15 03	16 04
20	6 33	5 17	12 54	13 44	14 40	15 42
30	6 51	5 28	12 31	13 18	14 14	15 17
35	7 02	5 33	12 18	13 04	13 58	15 02
40	7 14	5 39	12 03	12 46	13 40	14 45
45	7 28	5 45	11 44	12 26	13 19	14 24
50	7 45	5 51	11 22	12 00	12 51	13 58
52	7 53	5 53	11 12	11 47	12 38	13 45
54	8 02	5 55	11 00	11 33	12 23	13 31
56	8 12	5 58	10 46	11 16	12 04	13 14
58	8 23	6 01	10 30	10 56	11 42	12 53
60	8 36	6 03	10 11	10 32	11 14	12 27
S						

Lat.	Sunset	Twlt. ends	Moonset 21	22	23	24
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	■	■	■	■
70	▭	▭	■	■	■	■
68	22 54	////	■	■	■	■
66	22 05	////	■	■	■	■
64	21 35	////	21 02	■	■	23 47
62	21 12	////	21 46	22 03	22 58	24 38
60	20 54	////	22 16	22 45	23 41	25 09
58	20 39	////	22 38	23 13	24 10	0 10
56	20 26	////	22 57	23 35	24 33	0 33
54	20 15	////	23 12	23 53	24 51	0 51
52	20 05	////	23 26	24 08	0 08	1 07
50	19 57	22 54	23 37	24 21	0 21	1 20
45	19 38	21 52	24 02	0 02	0 49	1 48
40	19 23	21 17	24 22	0 22	1 10	2 10
35	19 11	20 52	24 38	0 38	1 28	2 27
30	19 00	20 32	0 09	0 53	1 44	2 43
20	18 41	20 02	0 30	1 17	2 10	3 09
10	18 25	19 41	0 48	1 38	2 33	3 32
0	18 10	19 23	1 05	1 58	2 54	3 52
10	17 55	19 09	1 23	2 17	3 15	4 13
20	17 39	18 56	1 41	2 38	3 37	4 36
30	17 22	18 45	2 03	3 03	4 03	5 01
35	17 11	18 39	2 15	3 17	4 19	5 17
40	16 59	18 34	2 30	3 34	4 37	5 34
45	16 45	18 28	2 47	3 54	4 58	5 55
50	16 28	18 23	3 08	4 20	5 26	6 22
52	16 20	18 21	3 19	4 32	5 39	6 35
54	16 11	18 18	3 30	4 46	5 54	6 49
56	16 01	18 16	3 43	5 02	6 13	7 07
58	15 50	18 14	3 59	5 22	6 35	7 27
60	15 37	18 11	4 17	5 46	7 03	7 53
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
21	19 45	9 00	11 51	9 06	17 25
22	20 40	9 01	11 50	9 03	17 22
23	21 38	9 01	11 49	9 00	17 18
24	22 38	9 02	11 48	8 57	17 14

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.2	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	21	22	23
°	′	′	′
0	14.4	15.4	16.6
4	14.4	15.4	16.6
8	14.4	15.4	16.6
12	14.4	15.4	16.5
16	14.4	15.4	16.5
20	14.5	15.4	16.5
24	14.5	15.4	16.5
28	14.5	15.4	16.5
32	14.6	15.4	16.4
36	14.6	15.4	16.4
40	14.6	15.4	16.4
44	14.7	15.5	16.3
48	14.7	15.5	16.3
52	14.8	15.5	16.2
56	14.8	15.5	16.2
60	14.9	15.5	16.1
64	14.9	15.5	16.1
68	15.0	15.5	16.0
72	15.1	15.5	16.0
76	15.1	15.5	15.9
80	15.2	15.5	15.9
84	15.2	15.5	15.8
88	15.3	15.5	15.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	21	22	23
°	′	′	′
0	16.2	15.6	15.0
4	16.2	15.6	15.0
8	16.2	15.6	15.0
12	16.2	15.6	15.0
16	16.2	15.6	15.0
20	16.1	15.6	15.0
24	16.1	15.6	15.0
28	16.1	15.6	15.1
32	16.1	15.6	15.1
36	16.0	15.6	15.1
40	16.0	15.6	15.2
44	15.9	15.6	15.2
48	15.9	15.6	15.3
52	15.8	15.6	15.3
56	15.8	15.6	15.3
60	15.7	15.6	15.4
64	15.7	15.6	15.4
68	15.6	15.6	15.5
72	15.6	15.6	15.5
76	15.5	15.5	15.6
80	15.4	15.5	15.7
84	15.4	15.5	15.7
88	15.3	15.5	15.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.7 GHA	VENUS −3.7 Dec.	MARS 1.9 GHA	MARS 1.9 Dec.	JUPITER −1.6 GHA	JUPITER −1.6 Dec.	SATURN 1.0 GHA	SATURN 1.0 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
24 0	301 25.3	224 32.0	+20 26.0	182 58.1	+21 55.1	225 32.8	+22 12.9	100 49.0	− 6 02.0	34 02.4	53	−26 30.6	+ 20
1	316 27.7	239 31.6	26.4	197 58.8	54.8	240 34.7	12.9	115 51.3	02.1	48 26.7	52	26 28.6	+ 22
2	331 30.2	254 31.2	26.7	212 59.6	54.5	255 36.7	13.0	130 53.7	02.1	62 50.9	52	26 26.4	+ 24
3	346 32.6	269 30.7	•• 27.1	228 00.3	•• 54.2	270 38.6	•• 13.0	145 56.0	•• 02.2	77 15.1	51	•26 24.0	+ 26
4	1 35.1	284 30.3	27.4	243 01.0	53.9	285 40.5	13.1	160 58.4	02.2	91 39.2	52	26 21.4	+ 27
5	16 37.6	299 29.8	27.8	258 01.8	53.6	300 42.5	13.1	176 00.7	02.3	106 03.4	51	26 18.7	+ 29
6	31 40.0	314 29.4	+20 28.1	273 02.5	+21 53.3	315 44.4	+22 13.2	191 03.1	− 6 02.4	120 27.5	51	−26 15.8	+ 30
7	46 42.5	329 29.0	28.5	288 03.3	53.0	330 46.3	13.2	206 05.4	02.4	134 51.6	51	26 12.8	+ 33
8	61 45.0	344 28.5	28.8	303 04.0	52.7	345 48.3	13.2	221 07.8	02.5	149 15.7	51	26 09.5	+ 34
9	76 47.4	359 28.1	•• 29.2	318 04.8	•• 52.4	0 50.2	•• 13.3	236 10.2	•• 02.5	163 39.8	51	•26 06.1	+ 36
10	91 49.9	14 27.6	29.5	333 05.5	52.1	15 52.1	13.3	251 12.5	02.6	178 03.9	51	26 02.5	+ 37
11	106 52.4	29 27.2	29.9	348 06.3	51.8	30 54.1	13.4	266 14.9	02.6	192 28.0	50	25 58.8	+ 40
12	121 54.8	44 26.8	+20 30.2	3 07.0	+21 51.5	45 56.0	+22 13.4	281 17.2	− 6 02.7	206 52.0	51	−25 54.8	+ 41
13	136 57.3	59 26.3	30.6	18 07.8	51.2	60 57.9	13.5	296 19.6	02.7	221 16.1	50	25 50.7	+ 43
14	151 59.8	74 25.9	30.9	33 08.5	50.9	75 59.9	13.5	311 21.9	02.8	235 40.1	51	25 46.4	+ 44
15	167 02.2	89 25.4	•• 31.2	48 09.3	•• 50.6	91 01.8	•• 13.6	326 24.3	•• 02.9	250 04.2	51	•25 42.0	+ 46
16	182 04.7	104 25.0	31.6	63 10.0	50.3	106 03.7	13.6	341 26.6	02.9	264 28.3	50	25 37.4	+ 48
17	197 07.1	119 24.5	31.9	78 10.8	50.0	121 05.7	13.7	356 29.0	03.0	278 52.3	51	25 32.6	+ 50
18	212 09.6	134 24.1	+20 32.3	93 11.5	+21 49.7	136 07.6	+22 13.7	11 31.3	− 6 03.0	293 16.4	51	−25 27.6	+ 52
19	227 12.1	149 23.6	32.6	108 12.2	49.4	151 09.6	13.8	26 33.7	03.1	307 40.5	51	25 22.4	+ 53
20	242 14.5	164 23.2	33.0	123 13.0	49.1	166 11.5	13.8	41 36.0	03.1	322 04.6	51	25 17.1	+ 55
21	257 17.0	179 22.7	•• 33.3	138 13.7	•• 48.8	181 13.4	•• 13.9	56 38.4	•• 03.2	336 28.7	51	•25 11.6	+ 56
22	272 19.5	194 22.3	33.6	153 14.5	48.5	196 15.4	13.9	71 40.7	03.2	350 52.8	51	25 06.0	+ 59
23	287 21.9	209 21.8	34.0	168 15.2	48.2	211 17.3	14.0	86 43.1	03.3	5 16.9	52	25 00.1	+ 60
25 0	302 24.4	224 21.4	+20 34.3	183 16.0	+21 47.9	226 19.2	+22 14.0	101 45.4	− 6 03.4	19 41.1	52	−24 54.1	+ 61
1	317 26.9	239 20.9	34.6	198 16.7	47.6	241 21.2	14.1	116 47.8	03.4	34 05.3	52	24 48.0	+ 64
2	332 29.3	254 20.5	35.0	213 17.5	47.3	256 23.1	14.1	131 50.1	03.5	48 29.5	52	24 41.6	+ 65
3	347 31.8	269 20.0	•• 35.3	228 18.2	•• 47.0	271 25.0	•• 14.2	146 52.5	•• 03.5	62 53.7	52	•24 35.1	+ 67
4	2 34.3	284 19.6	35.6	243 19.0	46.7	286 27.0	14.2	161 54.9	03.6	77 17.9	53	24 28.4	+ 68
5	17 36.7	299 19.1	36.0	258 19.7	46.4	301 28.9	14.3	176 57.2	03.6	91 42.2	53	24 21.6	+ 70
6	32 39.2	314 18.7	+20 36.3	273 20.5	+21 46.1	316 30.8	+22 14.3	191 59.6	− 6 03.7	106 06.5	53	−24 14.6	+ 72
7	47 41.6	329 18.2	36.6	288 21.2	45.8	331 32.8	14.4	207 01.9	03.8	120 30.8	54	24 07.4	+ 73
8	62 44.1	344 17.8	37.0	303 22.0	45.4	346 34.7	14.4	222 04.3	03.8	134 55.2	54	24 00.1	+ 76
9	77 46.6	359 17.3	•• 37.3	318 22.7	•• 45.1	1 36.7	•• 14.5	237 06.6	•• 03.9	149 19.6	54	•23 52.5	+ 76
10	92 49.0	14 16.9	37.6	333 23.5	44.8	16 38.6	14.5	252 09.0	03.9	163 44.0	55	23 44.9	+ 79
11	107 51.5	29 16.4	37.9	348 24.2	44.5	31 40.5	14.5	267 11.3	04.0	178 08.5	55	23 37.0	+ 80
12	122 54.0	44 16.0	+20 38.3	3 25.0	+21 44.2	46 42.5	+22 14.6	282 13.7	− 6 04.0	192 33.0	55	−23 29.0	+ 81
13	137 56.4	59 15.5	38.6	18 25.7	43.9	61 44.4	14.6	297 16.0	04.1	206 57.5	56	23 20.9	+ 83
14	152 58.9	74 15.0	38.9	33 26.5	43.6	76 46.3	14.7	312 18.4	04.1	221 22.1	56	23 12.6	+ 85
15	168 01.4	89 14.6	•• 39.2	48 27.2	•• 43.3	91 48.3	•• 14.7	327 20.7	•• 04.2	235 46.7	57	•23 04.1	+ 87
16	183 03.8	104 14.1	39.6	63 28.0	43.0	106 50.2	14.8	342 23.1	04.3	250 11.4	57	22 55.4	+ 88
17	198 06.3	119 13.7	39.9	78 28.7	42.7	121 52.2	14.8	357 25.4	04.3	264 36.1	57	22 46.6	+ 89
18	213 08.8	134 13.2	+20 40.2	93 29.5	+21 42.4	136 54.1	+22 14.9	12 27.8	− 6 04.4	279 00.8	58	−22 37.7	+ 91
19	228 11.2	149 12.8	40.5	108 30.2	42.1	151 56.0	14.9	27 30.1	04.4	293 25.6	59	22 28.6	+ 93
20	243 13.7	164 12.3	40.9	123 31.0	41.8	166 58.0	15.0	42 32.4	04.5	307 50.5	59	22 19.3	+ 94
21	258 16.1	179 11.8	•• 41.2	138 31.8	•• 41.5	181 59.9	•• 15.0	57 34.8	•• 04.5	322 15.4	59	•22 09.9	+ 95
22	273 18.6	194 11.4	41.5	153 32.5	41.1	197 01.9	15.1	72 37.1	04.6	336 40.3	60	22 00.4	+ 98
23	288 21.1	209 10.9	41.8	168 33.3	40.8	212 03.8	15.1	87 39.5	04.7	351 05.3	61	21 50.6	+ 98
26 0	303 23.5	224 10.4	+20 42.1	183 34.0	+21 40.5	227 05.7	+22 15.2	102 41.8	− 6 04.7	5 30.4	61	−21 40.8	+100
1	318 26.0	239 10.0	42.4	198 34.8	40.2	242 07.7	15.2	117 44.2	04.8	19 55.5	62	21 30.8	+102
2	333 28.5	254 09.5	42.8	213 35.5	39.9	257 09.6	15.3	132 46.5	04.8	34 20.7	62	21 20.6	+103
3	348 30.9	269 09.1	•• 43.1	228 36.3	•• 39.6	272 11.5	•• 15.3	147 48.9	•• 04.9	48 45.9	63	•21 10.3	+105
4	3 33.4	284 08.6	43.4	243 37.0	39.3	287 13.5	15.3	162 51.2	04.9	63 11.2	63	20 59.8	+105
5	18 35.9	299 08.1	43.7	258 37.8	39.0	302 15.4	15.4	177 53.6	05.0	77 36.5	64	20 49.3	+108
6	33 38.3	314 07.7	+20 44.0	273 38.5	+21 38.7	317 17.4	+22 15.4	192 55.9	− 6 05.1	92 01.9	64	−20 38.5	+109
7	48 40.8	329 07.2	44.3	288 39.3	38.4	332 19.3	15.5	207 58.3	05.1	106 27.3	65	20 27.6	+110
8	63 43.3	344 06.7	44.6	303 40.0	38.0	347 21.2	15.5	223 00.6	05.2	120 52.8	66	20 16.6	+111
9	78 45.7	359 06.3	•• 44.9	318 40.8	•• 37.7	2 23.2	•• 15.6	238 03.0	•• 05.2	135 18.4	66	•20 05.5	+113
10	93 48.2	14 05.8	45.3	333 41.5	37.4	17 25.1	15.6	253 05.3	05.3	149 44.0	67	19 54.2	+114
11	108 50.6	29 05.3	45.6	348 42.3	37.1	32 27.1	15.7	268 07.7	05.3	164 09.7	68	19 42.8	+116
12	123 53.1	44 04.9	+20 45.9	3 43.1	+21 36.8	47 29.0	+22 15.7	283 10.0	− 6 05.4	178 35.5	68	−19 31.2	+117
13	138 55.6	59 04.4	46.2	18 43.8	36.5	62 30.9	15.8	298 12.4	05.5	193 01.3	69	19 19.5	+118
14	153 58.0	74 03.9	46.5	33 44.6	36.2	77 32.9	15.8	313 14.7	05.5	207 27.2	69	19 07.7	+119
15	169 00.5	89 03.4	•• 46.8	48 45.3	•• 35.8	92 34.8	•• 15.9	328 17.1	•• 05.6	221 53.1	70	•18 55.8	+121
16	184 03.0	104 03.0	47.1	63 46.1	35.5	107 36.8	15.9	343 19.4	05.6	236 19.1	70	18 43.7	+122
17	199 05.4	119 02.5	47.4	78 46.8	35.2	122 38.7	16.0	358 21.7	05.7	250 45.1	72	18 31.5	+123
18	214 07.9	134 02.0	+20 47.7	93 47.6	+21 34.9	137 40.7	+22 16.0	13 24.1	− 6 05.8	265 11.3	72	−18 19.2	+125
19	229 10.4	149 01.6	48.0	108 48.3	34.6	152 42.6	16.0	28 26.4	05.8	279 37.5	72	18 06.7	+125
20	244 12.8	164 01.1	48.3	123 49.1	34.3	167 44.5	16.1	43 28.8	05.9	294 03.7	73	17 54.2	+127
21	259 15.3	179 00.6	•• 48.6	138 49.9	•• 34.0	182 46.5	•• 16.1	58 31.1	•• 05.9	308 30.0	74	•17 41.5	+128
22	274 17.7	194 00.1	48.9	153 50.6	33.6	197 48.4	16.2	73 33.5	06.0	322 56.4	75	17 28.7	+129
23	289 20.2	208 59.7	49.2	168 51.4	33.3	212 50.4	16.2	88 35.8	06.0	337 22.9	75	17 15.8	+130
24	304 22.7	223 59.2	+20 49.5	183 52.1	+21 33.0	227 52.3	+22 16.3	103 38.2	− 6 06.1	351 49.4	76	−17 02.8	+132
code	—	− 5	+ 3	+ 7	− 3	+ 19	0	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
24 0	178 24.3	+19 59.1
1	193 24.3	58.6
2	208 24.3	58.1
3	223 24.3	57.5
4	238 24.3	57.0
5	253 24.3	56.5
6	268 24.3	+19 56.0
7	283 24.2	55.5
8	298 24.2	54.9
9	313 24.2	54.4
10	328 24.2	53.9
11	343 24.2	53.4
12	358 24.2	+19 52.8
13	13 24.2	52.3
14	28 24.2	51.8
15	43 24.1	51.3
16	58 24.1	50.7
17	73 24.1	50.2
18	88 24.1	+19 49.7
19	103 24.1	49.2
20	118 24.1	48.6
21	133 24.1	48.1
22	148 24.1	47.6
23	163 24.1	47.0
25 0	178 24.1	+19 46.5
1	193 24.0	46.0
2	208 24.0	45.4
3	223 24.0	44.9
4	238 24.0	44.4
5	253 24.0	43.8
6	268 24.0	+19 43.3
7	283 24.0	42.8
8	298 24.0	42.2
9	313 24.0	41.7
10	328 24.0	41.2
11	343 24.0	40.6
12	358 24.0	+19 40.1
13	13 24.0	39.6
14	28 24.0	39.0
15	43 23.9	38.5
16	58 23.9	37.9
17	73 23.9	37.4
18	88 23.9	+19 36.9
19	103 23.9	36.3
20	118 23.9	35.8
21	133 23.9	35.2
22	148 23.9	34.7
23	163 23.9	34.1
26 0	178 23.9	+19 33.6
1	193 23.9	33.1
2	208 23.9	32.5
3	223 23.9	32.0
4	238 23.9	31.4
5	253 23.9	30.9
6	268 23.9	+19 30.3
7	283 23.9	29.8
8	298 23.9	29.2
9	313 23.9	28.7
10	328 23.9	28.1
11	343 23.9	27.6
12	358 23.9	+19 27.0
13	13 23.9	26.5
14	28 23.9	25.9
15	43 23.9	25.4
16	58 23.9	24.8
17	73 23.9	24.3
18	88 23.9	+19 23.7
19	103 23.9	23.1
20	118 23.9	22.6
21	133 23.9	22.0
22	148 23.9	21.5
23	163 23.9	20.9
24	178 23.9	+19 20.4
code	—	- 5

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.4	−40 29.0
5	Achernar	335 59.8	−57 27.9
30	Acrux	174 00.1	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.2	+16 25.2
32	Alioth	167 00.0	+56 12.9
34	Alkaid	153 34.1	+49 32.8
55	Al Na'ir	28 39.5	−47 11.0
15	Alnilam	276 32.2	− 1 13.6
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.8	+26 52.3
1	Alpheratz	358 29.9	+28 50.1
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.6	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.5
43	Atria	109 03.1	−68 57.0
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.7
16	Betelg'se	271 50.2	+ 7 24.1
17	Canopus	264 16.6	−52 39.9
12	Capella	281 41.2	+45 57.2
53	Deneb	50 01.7	+45 06.8
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.7	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 06.6	+51 29.7
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.1	−29 51.9
31	Gacrux	172 51.5	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.9	−60 09.4
6	Hamal	328 51.5	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.3	+74 20.9
57	Markab	14 22.9	+14 57.4
8	Menkar	315 02.1	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 45.0	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.5	− 8 15.0
38	Rigil Kent.	140 53.3	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.8	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.1

GMT	Equation of Time (App.—Mean) 24	25	26
h	m s	m s	m s
0	− 6 22.6	− 6 23.8	− 6 24.4
6	− 6 22.9	− 6 24.0	− 6 24.4
12	− 6 23.2	− 6 24.1	− 6 24.4
18	− 6 23.5	− 6 24.3	− 6 24.4
24	− 6 23.8	− 6 24.4	− 6 24.3

Lat. N °	Sunrise	Twlt. begins	Moonrise 24	25	26	27
	h m	h m	h m	h m	h m	h m
72	▭	▭	▬	▬	23 27	22 04
70	▭	▭	▬	▬	22 30	21 44
68	1 33	////	▬	23 22	21 56	21 29
66	2 16	////	▬	21 58	21 31	21 16
64	2 45	////	21 37	21 20	21 11	21 05
62	3 06	////	20 46	20 53	20 55	20 55
60	3 24	////	20 14	20 32	20 42	20 47
58	3 38	////	19 50	20 15	20 30	20 40
56	3 50	////	19 31	20 00	20 20	20 34
54	4 01	////	19 14	19 47	20 11	20 28
52	4 11	0 33	19 00	19 36	20 03	20 23
50	4 19	1 26	18 48	19 26	19 56	20 18
45	4 37	2 24	18 22	19 05	19 40	20 08
40	4 52	2 58	18 02	18 48	19 27	20 00
35	5 04	3 23	17 45	18 34	19 16	19 52
30	5 15	3 42	17 30	18 21	19 06	19 46
20	5 33	4 11	17 06	18 00	18 49	19 35
10	5 48	4 33	16 44	17 41	18 35	19 25
0	6 03	4 50	16 24	17 23	18 21	19 16
10	6 17	5 03	16 04	17 05	18 07	19 06
20	6 32	5 16	15 42	16 47	17 52	18 56
30	6 50	5 27	15 17	16 25	17 35	18 45
35	7 00	5 33	15 02	16 12	17 25	18 38
40	7 11	5 37	14 45	15 57	17 13	18 31
45	7 25	5 43	14 24	15 39	17 00	18 22
50	7 41	5 48	13 58	15 17	16 43	18 11
52	7 49	5 50	13 45	15 06	16 35	18 06
54	7 58	5 52	13 31	14 54	16 26	18 00
56	8 07	5 55	13 14	14 41	16 17	17 54
58	8 18	5 57	12 53	14 25	16 05	17 47
60 S	8 31	6 00	12 27	14 05	15 52	17 39

Lat. N °	Sunset	Twlt. ends	Moonset 24	25	26	27
	h m	h m	h m	h m	h m	h m
72	▭	▭	▬	▬	▬	2 06
70	▭	▭	▬	▬	▬	3 00
68	22 34	////	▬	▬	0 10	3 33
66	21 53	////	▬	▬	1 31	3 57
64	21 26	////	23 47	26 08	2 08	4 15
62	21 05	////	24 38	0 38	2 34	4 30
60	20 48	////	25 09	1 09	2 54	4 43
58	20 33	////	0 10	1 33	3 11	4 53
56	20 21	////	0 33	1 52	3 25	5 02
54	20 11	////	0 51	2 08	3 37	5 11
52	20 01	23 29	1 07	2 22	3 48	5 18
50	19 53	22 42	1 20	2 34	3 57	5 25
45	19 35	21 46	1 48	2 58	4 17	5 39
40	19 21	21 13	2 10	3 18	4 33	5 50
35	19 09	20 49	2 27	3 34	4 46	6 00
30	18 58	20 29	2 43	3 49	4 58	6 08
20	18 40	20 01	3 09	4 13	5 18	6 23
10	18 24	19 39	3 32	4 33	5 35	6 35
0	18 10	19 23	3 52	4 52	5 51	6 47
10	17 56	19 10	4 13	5 11	6 07	6 59
20	17 40	18 57	4 36	5 32	6 23	7 11
30	17 23	18 46	5 01	5 55	6 43	7 25
35	17 13	18 41	5 17	6 08	6 54	7 33
40	17 02	18 37	5 34	6 24	7 06	7 42
45	16 48	18 31	5 55	6 43	7 21	7 53
50	16 32	18 26	6 22	7 06	7 39	8 05
52	16 24	18 24	6 35	7 17	7 48	8 11
54	16 16	18 22	6 49	7 29	7 57	8 17
56	16 06	18 20	7 07	7 44	8 08	8 25
58	15 55	18 17	7 27	8 00	8 20	8 33
60 S	15 43	18 16	7 53	8 20	8 34	8 42

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
24	22 38	9 02	11 48	8 57	17 14
25	23 37	9 03	11 46	8 54	17 10
26	24 34	9 04	11 45	8 51	17 07
27	0 34	9 04	11 44	8 47	17 03

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	24	25	26
°	′	′	′
0	17.6	18.6	19.4
4	17.6	18.6	19.4
8	17.6	18.6	19.3
12	17.5	18.5	19.3
16	17.5	18.5	19.2
20	17.5	18.4	19.2
24	17.4	18.4	19.1
28	17.4	18.3	19.0
32	17.3	18.2	18.9
36	17.2	18.1	18.7
40	17.2	18.0	18.6
44	17.1	17.9	18.5
48	17.0	17.7	18.3
52	16.9	17.6	18.1
56	16.8	17.5	18.0
60	16.7	17.3	17.8
64	16.6	17.2	17.6
68	16.5	17.0	17.4
72	16.4	16.9	17.2
76	16.3	16.7	17.0
80	16.2	16.5	16.8
84	16.1	16.4	16.6
88	16.0	16.2	16.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	24	25	26
°	′	′	′
0	14.4	13.8	13.4
4	14.4	13.8	13.4
8	14.4	13.8	13.4
12	14.4	13.9	13.5
16	14.5	13.9	13.5
20	14.5	14.0	13.6
24	14.5	14.0	13.7
28	14.6	14.1	13.8
32	14.7	14.2	13.9
36	14.7	14.3	14.0
40	14.8	14.4	14.1
44	14.9	14.5	14.3
48	15.0	14.7	14.4
52	15.0	14.8	14.6
56	15.1	14.9	14.8
60	15.2	15.1	15.0
64	15.3	15.2	15.1
68	15.4	15.4	15.3
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.8	15.9	15.9
84	15.9	16.0	16.2
88	16.0	16.2	16.3
90			

Subtract from table, back cover

Full Moon 26

GMT	♈ GHA	VENUS −3.6 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
27 0	304 22.7	223 59.2	+20 49.5	183 52.1	+21 33.0	227 52.3	+22 16.3	103 38.2	− 6 06.1	351 49.4	76	−17 02.8	+132
1	319 25.1	238 58.7	49.8	198 52.9	32.7	242 54.2	16.3	118 40.5	06.2	6 16.0	76	16 49.6	+132
2	334 27.6	253 58.2	50.1	213 53.6	32.4	257 56.2	16.4	133 42.8	06.2	20 42.6	77	16 36.4	+134
3	349 30.1	268 57.8	•• 50.4	228 54.4	•• 32.1	272 58.1	•• 16.4	148 45.2	•• 06.3	35 09.3	78	•16 23.0	+134
4	4 32.5	283 57.3	50.7	243 55.2	31.7	288 00.1	16.5	163 47.5	06.3	49 36.1	78	16 09.6	+136
5	19 35.0	298 56.8	51.0	258 55.9	31.4	303 02.0	16.5	178 49.9	06.4	64 02.9	79	15 56.0	+137
6	34 37.5	313 56.3	+20 51.3	273 56.7	+21 31.1	318 04.0	+22 16.6	193 52.2	− 6 06.5	78 29.8	80	−15 42.3	+138
7	49 39.9	328 55.8	51.6	288 57.4	30.8	333 05.9	16.6	208 54.6	06.5	92 56.8	80	15 28.5	+138
8	64 42.4	343 55.4	51.9	303 58.2	30.5	348 07.9	16.6	223 56.9	06.6	107 23.8	81	15 14.7	+140
9	79 44.9	358 54.9	•• 52.1	318 58.9	•• 30.2	3 09.8	•• 16.7	238 59.3	•• 06.6	121 50.9	82	•15 00.7	+141
10	94 47.3	13 54.4	52.4	333 59.7	29.8	18 11.7	16.7	254 01.6	06.7	136 18.1	82	14 46.6	+141
11	109 49.8	28 53.9	52.7	349 00.5	29.5	33 13.7	16.8	269 03.9	06.8	150 45.3	83	14 32.5	+143
12	124 52.2	43 53.4	+20 53.0	4 01.2	+21 29.2	48 15.6	+22 16.8	284 06.3	− 6 06.8	165 12.6	84	−14 18.2	+144
13	139 54.7	58 53.0	53.3	19 02.0	28.9	63 17.6	16.9	299 08.6	06.9	179 40.0	84	14 03.8	+144
14	154 57.2	73 52.5	53.6	34 02.7	28.6	78 19.5	16.9	314 11.0	06.9	194 07.4	84	13 49.4	+145
15	169 59.6	88 52.0	•• 53.9	49 03.5	•• 28.2	93 21.5	•• 17.0	329 13.3	•• 07.0	208 34.8	86	•13 34.9	+146
16	185 02.1	103 51.5	54.2	64 04.3	27.9	108 23.4	17.0	344 15.7	07.0	223 02.4	86	13 20.3	+147
17	200 04.6	118 51.0	54.4	79 05.0	27.6	123 25.3	17.1	359 18.0	07.1	237 30.0	86	13 05.6	+148
18	215 07.0	133 50.5	+20 54.7	94 05.8	+21 27.3	138 27.3	+22 17.1	14 20.3	− 6 07.2	251 57.6	87	−12 50.8	+148
19	230 09.5	148 50.1	55.0	109 06.5	27.0	153 29.2	17.1	29 22.7	07.2	266 25.3	88	12 36.0	+150
20	245 12.0	163 49.6	55.3	124 07.3	26.6	168 31.2	17.2	44 25.0	07.3	280 53.1	88	12 21.0	+150
21	260 14.4	178 49.1	•• 55.6	139 08.1	•• 26.3	183 33.1	•• 17.2	59 27.4	•• 07.3	295 20.9	89	•12 06.0	+151
22	275 16.9	193 48.6	55.9	154 08.8	26.0	198 35.1	17.3	74 29.7	07.4	309 48.8	90	11 50.9	+151
23	290 19.4	208 48.1	56.1	169 09.6	25.7	213 37.0	17.3	89 32.1	07.5	324 16.8	90	11 35.8	+153
28 0	305 21.8	223 47.6	+20 56.4	184 10.3	+21 25.3	228 39.0	+22 17.4	104 34.4	− 6 07.5	338 44.8	90	−11 20.5	+153
1	320 24.3	238 47.1	56.7	199 11.1	25.0	243 40.9	17.4	119 36.7	07.6	353 12.8	92	11 05.2	+153
2	335 26.7	253 46.7	57.0	214 11.9	24.7	258 42.9	17.5	134 39.1	07.6	7 41.0	91	10 49.9	+154
3	350 29.2	268 46.2	•• 57.2	229 12.6	•• 24.4	273 44.8	•• 17.5	149 41.4	•• 07.7	22 09.1	93	•10 34.5	+155
4	5 31.7	283 45.7	57.5	244 13.4	24.0	288 46.8	17.5	164 43.8	07.8	36 37.4	92	10 19.0	+156
5	20 34.1	298 45.2	57.8	259 14.1	23.7	303 48.7	17.6	179 46.1	07.8	51 05.6	94	10 03.4	+156
6	35 36.6	313 44.7	+20 58.1	274 14.9	+21 23.4	318 50.6	+22 17.6	194 48.4	− 6 07.9	65 34.0	93	− 9 47.8	+157
7	50 39.1	328 44.2	58.3	289 15.7	23.1	333 52.6	17.7	209 50.8	07.9	80 02.3	95	9 32.1	+157
8	65 41.5	343 43.7	58.6	304 16.4	22.7	348 54.5	17.7	224 53.1	08.0	94 30.8	95	9 16.4	+158
9	80 44.0	358 43.2	•• 58.9	319 17.2	•• 22.4	3 56.5	•• 17.8	239 55.5	•• 08.1	108 59.3	95	• 9 00.6	+158
10	95 46.5	13 42.7	59.2	334 17.9	22.1	18 58.4	17.8	254 57.8	08.1	123 27.8	96	8 44.8	+159
11	110 48.9	28 42.2	59.4	349 18.7	21.8	34 00.4	17.9	270 00.1	08.2	137 56.4	96	8 28.9	+159
12	125 51.4	43 41.8	+20 59.7	4 19.5	+21 21.4	49 02.3	+22 17.9	285 02.5	− 6 08.2	152 25.0	97	− 8 13.0	+160
13	140 53.9	58 41.3	21 00.0	19 20.2	21.1	64 04.3	17.9	300 04.8	08.3	166 53.7	97	7 57.0	+160
14	155 56.3	73 40.8	00.2	34 21.0	20.8	79 06.2	18.0	315 07.2	08.4	181 22.4	97	7 41.0	+161
15	170 58.8	88 40.3	•• 00.5	49 21.8	•• 20.5	94 08.2	•• 18.0	330 09.5	•• 08.4	195 51.1	98	• 7 24.9	+161
16	186 01.2	103 39.8	00.8	64 22.5	20.1	109 10.1	18.1	345 11.8	08.5	210 19.9	99	7 08.8	+161
17	201 03.7	118 39.3	01.0	79 23.3	19.8	124 12.1	18.1	0 14.2	08.5	224 48.8	99	6 52.7	+162
18	216 06.2	133 38.8	+21 01.3	94 24.1	+21 19.5	139 14.0	+22 18.2	15 16.5	− 6 08.6	239 17.7	99	− 6 36.5	+162
19	231 08.6	148 38.3	01.6	109 24.8	19.2	154 16.0	18.2	30 18.9	08.7	253 46.6	100	6 20.3	+163
20	246 11.1	163 37.8	01.8	124 25.6	18.8	169 17.9	18.3	45 21.2	08.7	268 15.6	100	6 04.0	+163
21	261 13.6	178 37.3	•• 02.1	139 26.3	•• 18.5	184 19.9	•• 18.3	60 23.5	•• 08.8	282 44.6	100	• 5 47.7	+163
22	276 16.0	193 36.8	02.3	154 27.1	18.2	199 21.8	18.3	75 25.9	08.8	297 13.6	101	5 31.4	+163
23	291 18.5	208 36.3	02.6	169 27.9	17.8	214 23.8	18.4	90 28.2	08.9	311 42.7	101	5 15.1	+164
29 0	306 21.0	223 35.8	+21 02.9	184 28.6	+21 17.5	229 25.7	+22 18.4	105 30.5	− 6 09.0	326 11.8	102	− 4 58.7	+164
1	321 23.4	238 35.3	03.1	199 29.4	17.2	244 27.7	18.5	120 32.9	09.0	340 41.0	102	4 42.3	+164
2	336 25.9	253 34.8	03.4	214 30.2	16.9	259 29.6	18.5	135 35.2	09.1	355 10.2	102	4 25.9	+164
3	351 28.3	268 34.3	•• 03.6	229 30.9	•• 16.5	274 31.6	•• 18.6	150 37.6	•• 09.2	9 39.4	103	• 4 09.5	+165
4	6 30.8	283 33.8	03.9	244 31.7	16.2	289 33.5	18.6	165 39.9	09.2	24 08.7	102	3 53.0	+165
5	21 33.3	298 33.3	04.1	259 32.5	15.9	304 35.5	18.7	180 42.2	09.3	38 37.9	103	3 36.5	+164
6	36 35.7	313 32.8	+21 04.4	274 33.2	+21 15.5	319 37.4	+22 18.7	195 44.6	− 6 09.3	53 07.2	104	− 3 20.1	+165
7	51 38.2	328 32.3	04.6	289 34.0	15.2	334 39.4	18.7	210 46.9	09.4	67 36.6	103	3 03.6	+166
8	66 40.7	343 31.8	04.9	304 34.8	14.9	349 41.3	18.8	225 49.2	09.5	82 05.9	104	2 47.0	+165
9	81 43.1	358 31.3	•• 05.2	319 35.5	•• 14.5	4 43.3	•• 18.8	240 51.6	•• 09.5	96 35.3	105	• 2 30.5	+165
10	96 45.6	13 30.8	05.4	334 36.3	14.2	19 45.2	18.9	255 53.9	09.6	111 04.8	104	2 14.0	+165
11	111 48.1	28 30.3	05.7	349 37.1	13.9	34 47.2	18.9	270 56.3	09.6	125 34.2	105	1 57.5	+166
12	126 50.5	43 29.8	+21 05.9	4 37.8	+21 13.5	49 49.1	+22 19.0	285 58.6	− 6 09.7	140 03.7	104	− 1 40.9	+165
13	141 53.0	58 29.3	06.1	19 38.6	13.2	64 51.1	19.0	301 00.9	09.8	154 33.1	105	1 24.4	+166
14	156 55.5	73 28.8	06.4	34 39.4	12.9	79 53.0	19.0	316 03.3	09.8	169 02.6	106	1 07.8	+165
15	171 57.9	88 28.3	•• 06.6	49 40.1	•• 12.5	94 55.0	•• 19.1	331 05.6	•• 09.9	183 32.2	105	• 0 51.3	+166
16	187 00.4	103 27.7	06.9	64 40.9	12.2	109 56.9	19.1	346 07.9	10.0	198 01.7	106	0 34.7	+165
17	202 02.8	118 27.2	07.1	79 41.7	11.9	124 58.9	19.2	1 10.3	10.0	212 31.3	105	0 18.2	+166
18	217 05.3	133 26.7	+21 07.4	94 42.4	+21 11.5	140 00.8	+22 19.2	16 12.6	− 6 10.1	227 00.8	106	− 0 01.6	+165
19	232 07.8	148 26.2	07.6	109 43.2	11.2	155 02.8	19.3	31 14.9	10.1	241 30.4	106	+ 0 14.9	+165
20	247 10.2	163 25.7	07.9	124 44.0	10.9	170 04.7	19.3	46 17.3	10.2	256 00.0	106	0 31.4	+165
21	262 12.7	178 25.2	•• 08.1	139 44.7	•• 10.5	185 06.7	•• 19.3	61 19.6	•• 10.3	270 29.6	107	• 0 47.9	+165
22	277 15.2	193 24.7	08.3	154 45.5	10.2	200 08.6	19.4	76 21.9	10.3	284 59.3	106	1 04.4	+165
23	292 17.6	208 24.2	08.6	169 46.3	09.9	215 10.6	19.4	91 24.3	10.4	299 28.9	106	1 20.9	+165
24	307 20.1	223 23.7	+21 08.8	184 47.0	+21 09.5	230 12.5	+22 19.5	106 26.6	− 6 10.4	313 58.5	107	+ 1 37.4	+164
code	−	− 5	+ 3	+ 7	− 3	+ 20	0	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
27 h 0	178 23.9	+19 20.4
1	193 23.9	19.8
2	208 23.9	19.2
3	223 23.9	18.7
4	238 23.9	18.1
5	253 23.9	17.6
6	268 23.9	+19 17.0
7	283 24.0	16.4
8	298 24.0	15.9
9	313 24.0	15.3
10	328 24.0	14.7
11	343 24.0	14.2
12	358 24.0	+19 13.6
13	13 24.0	13.1
14	28 24.0	12.5
15	43 24.0	11.9
16	58 24.0	11.4
17	73 24.0	10.8
18	88 24.0	+19 10.2
19	103 24.0	09.7
20	118 24.0	09.1
21	133 24.0	08.5
22	148 24.1	07.9
23	163 24.1	07.4
28 0	178 24.1	+19 06.8
1	193 24.1	06.2
2	208 24.1	05.7
3	223 24.1	05.1
4	238 24.1	04.5
5	253 24.1	03.9
6	268 24.1	+19 03.4
7	283 24.2	02.8
8	298 24.2	02.2
9	313 24.2	01.6
10	328 24.2	01.1
11	343 24.2	19 00.5
12	358 24.2	+18 59.9
13	13 24.2	59.3
14	28 24.2	58.8
15	43 24.2	58.2
16	58 24.3	57.6
17	73 24.3	57.0
18	88 24.3	+18 56.4
19	103 24.3	55.8
20	118 24.3	55.3
21	133 24.3	54.7
22	148 24.3	54.1
23	163 24.4	53.5
29 0	178 24.4	+18 52.9
1	193 24.4	52.3
2	208 24.4	51.8
3	223 24.4	51.2
4	238 24.4	50.6
5	253 24.5	50.0
6	268 24.5	+18 49.4
7	283 24.5	48.8
8	298 24.5	48.2
9	313 24.5	47.7
10	328 24.6	47.1
11	343 24.6	46.5
12	358 24.6	+18 45.9
13	13 24.6	45.3
14	28 24.6	44.7
15	43 24.6	44.1
16	58 24.7	43.5
17	73 24.7	42.9
18	88 24.7	+18 42.3
19	103 24.7	41.7
20	118 24.7	41.1
21	133 24.8	40.5
22	148 24.8	39.9
23	163 24.8	39.3
24	178 24.8	+18 38.8
code	—	- 6

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.4	−40 29.0
5	Achernar	335 59.8	−57 27.9
30	Acrux	174 00.2	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.1	+16 25.2
32	Alioth	167 00.0	+56 12.9
34	Alkaid	153 34.1	+49 32.8
55	Al Na'ir	28 39.5	−47 11.0
15	Alnilam	276 32.2	− 1 13.6
25	Alphard	218 40.5	− 8 27.4
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.9	+28 50.1
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.6	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.5
43	Atria	109 03.1	−68 57.1
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.7
16	Betelg'se	271 50.2	+ 7 24.1
17	Canopus	264 16.6	−52 39.9
12	Capella	281 41.2	+45 57.2
53	Deneb	50 01.7	+45 06.9
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.7	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 06.6	+51 29.7
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.1	−29 51.9
31	Gacrux	172 51.5	−56 51.5
29	Gienah	176 38.7	−17 17.2
35	Hadar	149 51.9	−60 09.4
6	Hamal	328 51.5	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.3	+74 20.9
57	Markab	14 22.9	+14 57.4
8	Menkar	315 02.1	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 44.9	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.4	− 8 15.0
38	Rigil Kent.	140 53.3	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.8	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.1	−15 51.1

GMT	Equation of Time (App.—Mean) 27	28	29
h	m s	m s	m s
0	− 6 24.3	− 6 23.7	− 6 22.5
6	− 6 24.2	− 6 23.5	− 6 22.1
12	− 6 24.1	− 6 23.2	− 6 21.7
18	− 6 23.9	− 6 22.9	− 6 21.2
24	− 6 23.7	− 6 22.5	− 6 20.7

Lat.	Sunrise	Twlt. begins	Moonrise 27	28	29	30
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	22 04	21 24	20 51	20 17
70	0 28	////	21 44	21 16	20 51	20 27
68	1 52	////	21 29	21 09	20 52	20 35
66	2 28	////	21 16	21 03	20 53	20 42
64	2 54	////	21 05	20 59	20 53	20 47
62	3 14	////	20 55	20 55	20 54	20 52
60	3 31	////	20 47	20 51	20 54	20 57
58	3 44	////	20 40	20 48	20 54	21 01
56	3 56	////	20 34	20 45	20 55	21 04
54	4 06	////	20 28	20 42	20 55	21 07
52	4 15	0 58	20 23	20 40	20 55	21 10
50	4 23	1 37	20 18	20 38	20 55	21 13
45	4 40	2 30	20 08	20 33	20 56	21 19
40	4 54	3 02	20 00	20 29	20 56	21 23
35	5 06	3 26	19 52	20 25	20 57	21 27
30	5 16	3 45	19 46	20 22	20 57	21 31
20	5 34	4 13	19 35	20 17	20 58	21 38
10	5 49	4 34	19 25	20 12	20 58	21 43
0	6 03	4 50	19 16	20 08	20 59	21 49
10	6 17	5 04	19 06	20 03	20 59	21 54
20	6 31	5 15	18 56	19 59	21 00	22 00
30	6 48	5 26	18 45	19 53	21 01	22 07
35	6 58	5 31	18 38	19 50	21 01	22 11
40	7 09	5 36	18 31	19 47	21 02	22 16
45	7 22	5 40	18 22	19 43	21 02	22 21
50	7 37	5 45	18 11	19 38	21 03	22 27
52	7 45	5 47	18 06	19 35	21 03	22 30
54	7 53	5 48	18 00	19 33	21 04	22 34
56	8 02	5 51	17 54	19 30	21 04	22 37
58	8 13	5 53	17 47	19 27	21 05	22 41
60 S	8 24	5 55	17 39	19 24	21 05	22 46

Lat.	Sunset	Twlt. ends	Moonset 27	28	29	30
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	2 06	5 23	7 54	10 18
70	23 24	////	3 00	5 40	7 59	10 11
68	22 16	////	3 33	5 54	8 02	10 06
66	21 41	////	3 57	6 05	8 05	10 02
64	21 16	////	4 15	6 14	8 08	9 58
62	20 57	////	4 30	6 22	8 10	9 55
60	20 41	////	4 43	6 29	8 12	9 53
58	20 27	////	4 53	6 34	8 13	9 50
56	20 16	////	5 02	6 40	8 15	9 48
54	20 06	////	5 11	6 44	8 16	9 46
52	19 57	23 09	5 18	6 48	8 17	9 45
50	19 49	22 32	5 25	6 52	8 18	9 43
45	19 32	21 41	5 39	7 00	8 21	9 40
40	19 18	21 08	5 50	7 07	8 23	9 37
35	19 06	20 45	6 00	7 13	8 24	9 35
30	18 56	20 27	6 08	7 18	8 26	9 32
20	18 39	19 59	6 23	7 26	8 28	9 29
10	18 24	19 39	6 35	7 34	8 30	9 25
0	18 10	19 23	6 47	7 41	8 32	9 22
10	17 56	19 09	6 59	7 48	8 34	9 19
20	17 41	18 57	7 11	7 55	8 36	9 16
30	17 25	18 48	7 25	8 03	8 38	9 12
35	17 15	18 43	7 33	8 08	8 39	9 10
40	17 04	18 38	7 42	8 13	8 41	9 08
45	16 51	18 33	7 53	8 19	8 42	9 05
50	16 36	18 29	8 05	8 26	8 44	9 02
52	16 28	18 27	8 11	8 29	8 45	9 00
54	16 20	18 25	8 17	8 33	8 46	8 59
56	16 11	18 24	8 25	8 37	8 47	8 57
58	16 01	18 22	8 33	8 41	8 48	8 55
60 S	15 49	18 20	8 42	8 46	8 50	8 53

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
27	0 34	9 04	11 44	8 47	17 03
28	1 28	9 05	11 43	8 44	16 59
29	2 20	9 06	11 42	8 41	16 55
30	3 11	9 07	11 40	8 38	16 52

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	27	28	29
°	′	′	′
0	19.9	20.0	19.9
4	19.9	20.0	19.9
8	19.8	20.0	19.8
12	19.8	19.9	19.8
16	19.7	19.8	19.7
20	19.6	19.8	19.6
24	19.5	19.6	19.5
28	19.4	19.5	19.4
32	19.3	19.4	19.3
36	19.2	19.3	19.2
40	19.0	19.1	19.0
44	18.8	18.9	18.8
48	18.7	18.8	18.7
52	18.5	18.6	18.5
56	18.3	18.4	18.3
60	18.1	18.1	18.1
64	17.9	17.9	17.9
68	17.6	17.7	17.6
72	17.4	17.5	17.4
76	17.2	17.2	17.2
80	17.0	17.0	17.0
84	16.7	16.7	16.7
88	16.5	16.6	16.5
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	27	28	29
°	′	′	′
0	13.1	13.0	13.1
4	13.1	13.0	13.1
8	13.1	13.1	13.1
12	13.2	13.1	13.2
16	13.2	13.2	13.2
20	13.3	13.3	13.3
24	13.4	13.4	13.4
28	13.5	13.5	13.5
32	13.7	13.6	13.7
36	13.8	13.7	13.8
40	13.9	13.9	13.9
44	14.1	14.1	14.1
48	14.3	14.3	14.3
52	14.5	14.4	14.5
56	14.7	14.6	14.7
60	14.9	14.9	14.9
64	15.1	15.1	15.1
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.0	16.0	16.0
84	16.2	16.3	16.2
88	16.4	16.4	16.4
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.6 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
30 0	307 20.1	223 23.7	+21 08.8	184 47.0	+21 09.5	230 12.5	+22 19.5	106 26.6	− 6 10.4	313 58.5	107	+ 1 37.4	+164
1	322 22.6	238 23.2	09.1	199 47.8	09.2	245 14.5	19.5	121 28.9	10.5	328 28.2	106	1 53.8	+165
2	337 25.0	253 22.7	09.3	214 48.6	08.9	260 16.4	19.6	136 31.3	10.6	342 57.8	107	2 10.3	+164
3	352 27.5	268 22.1	•• 09.5	229 49.3	•• 08.5	275 18.4	•• 19.6	151 33.6	•• 10.6	357 27.5	107	• 2 26.7	+164
4	7 30.0	283 21.6	09.8	244 50.1	08.2	290 20.3	19.7	166 36.0	10.7	11 57.2	106	2 43.1	+163
5	22 32.4	298 21.1	10.0	259 50.9	07.8	305 22.3	19.7	181 38.3	10.8	26 26.8	107	2 59.4	+164
6	37 34.9	313 20.6	+21 10.2	274 51.7	+21 07.5	320 24.3	+22 19.7	196 40.6	− 6 10.8	40 56.5	107	+ 3 15.8	+163
7	52 37.3	328 20.1	10.5	289 52.4	07.2	335 26.2	19.8	211 43.0	10.9	55 26.2	107	3 32.1	+163
8	67 39.8	343 19.6	10.7	304 53.2	06.8	350 28.2	19.8	226 45.3	10.9	69 55.9	106	3 48.4	+162
9	82 42.3	358 19.1	•• 10.9	319 54.0	•• 06.5	5 30.1	•• 19.9	241 47.6	•• 11.0	84 25.5	107	• 4 04.6	+162
10	97 44.7	13 18.5	11.2	334 54.7	06.2	20 32.1	19.9	256 50.0	11.1	98 55.2	107	4 20.8	+162
11	112 47.2	28 18.0	11.4	349 55.5	05.8	35 34.0	19.9	271 52.3	11.1	113 24.9	106	4 37.0	+162
12	127 49.7	43 17.5	+21 11.6	4 56.3	+21 05.5	50 36.0	+22 20.0	286 54.6	− 6 11.2	127 54.5	107	+ 4 53.2	+161
13	142 52.1	58 17.0	11.9	19 57.0	05.1	65 37.9	20.0	301 57.0	11.3	142 24.2	106	5 09.3	+161
14	157 54.6	73 16.5	12.1	34 57.8	04.8	80 39.9	20.1	316 59.3	11.3	156 53.8	107	5 25.4	+160
15	172 57.1	88 16.0	•• 12.3	49 58.6	•• 04.5	95 41.8	•• 20.1	332 01.6	•• 11.4	171 23.5	106	• 5 41.4	+160
16	187 59.5	103 15.4	12.5	64 59.4	04.1	110 43.8	20.2	347 04.0	11.5	185 53.1	106	5 57.4	+160
17	203 02.0	118 14.9	12.8	80 00.1	03.8	125 45.8	20.2	2 06.3	11.5	200 22.7	106	6 13.4	+159
18	218 04.4	133 14.4	+21 13.0	95 00.9	+21 03.4	140 47.7	+22 20.2	17 08.6	− 6 11.6	214 52.3	106	+ 6 29.3	+159
19	233 06.9	148 13.9	13.2	110 01.7	03.1	155 49.7	20.3	32 10.9	11.6	229 21.9	106	6 45.2	+158
20	248 09.4	163 13.4	13.4	125 02.4	02.8	170 51.6	20.3	47 13.3	11.7	243 51.5	106	7 01.0	+157
21	263 11.8	178 12.8	•• 13.6	140 03.2	•• 02.4	185 53.6	•• 20.4	62 15.6	•• 11.8	258 21.1	105	• 7 16.7	+158
22	278 14.3	193 12.3	13.9	155 04.0	02.1	200 55.5	20.4	77 17.9	11.8	272 50.6	106	7 32.5	+156
23	293 16.8	208 11.8	14.1	170 04.8	01.7	215 57.5	20.5	92 20.3	11.9	287 20.2	105	7 48.1	+156
31 0	308 19.2	223 11.3	+21 14.3	185 05.5	+21 01.4	230 59.4	+22 20.5	107 22.6	− 6 12.0	301 49.7	105	+ 8 03.7	+156
1	323 21.7	238 10.8	14.5	200 06.3	01.1	246 01.4	20.5	122 24.9	12.0	316 19.2	105	8 19.3	+155
2	338 24.2	253 10.2	14.7	215 07.1	00.7	261 03.4	20.6	137 27.3	12.1	330 48.7	104	8 34.8	+154
3	353 26.6	268 09.7	•• 15.0	230 07.8	•• 00.4	276 05.3	•• 20.6	152 29.6	•• 12.1	345 18.1	105	• 8 50.2	+154
4	8 29.1	283 09.2	15.2	245 08.6	21 00.0	291 07.3	20.7	167 31.9	12.2	359 47.6	104	9 05.6	+153
5	23 31.6	298 08.7	15.4	260 09.4	20 59.7	306 09.2	20.7	182 34.3	12.3	14 17.0	104	9 20.9	+153
6	38 34.0	313 08.2	+21 15.6	275 10.2	+20 59.3	321 11.2	+22 20.7	197 36.6	− 6 12.3	28 46.4	104	+ 9 36.2	+152
7	53 36.5	328 07.6	15.8	290 10.9	59.0	336 13.1	20.8	212 38.9	12.4	43 15.8	103	9 51.4	+151
8	68 38.9	343 07.1	16.0	305 11.7	58.6	351 15.1	20.8	227 41.3	12.5	57 45.1	103	10 06.5	+151
9	83 41.4	358 06.6	•• 16.2	320 12.5	•• 58.3	6 17.1	•• 20.9	242 43.6	•• 12.5	72 14.4	103	•10 21.6	+150
10	98 43.9	13 06.0	16.4	335 13.3	58.0	21 19.0	20.9	257 45.9	12.6	86 43.7	103	10 36.6	+149
11	113 46.3	28 05.5	16.7	350 14.0	57.6	36 21.0	21.0	272 48.2	12.7	101 13.0	102	10 51.5	+149
12	128 48.8	43 05.0	+21 16.9	5 14.8	+20 57.3	51 22.9	+22 21.0	287 50.6	− 6 12.7	115 42.2	102	+11 06.4	+147
13	143 51.3	58 04.5	17.1	20 15.6	56.9	66 24.9	21.0	302 52.9	12.8	130 11.4	102	11 21.1	+147
14	158 53.7	73 03.9	17.3	35 16.4	56.6	81 26.9	21.1	317 55.2	12.9	144 40.6	101	11 35.8	+147
15	173 56.2	88 03.4	•• 17.5	50 17.1	•• 56.2	96 28.8	•• 21.1	332 57.6	•• 12.9	159 09.7	102	•11 50.5	+145
16	188 58.7	103 02.9	17.7	65 17.9	55.9	111 30.8	21.2	347 59.9	13.0	173 38.9	100	12 05.0	+145
17	204 01.1	118 02.4	17.9	80 18.7	55.5	126 32.7	21.2	3 02.2	13.0	188 07.9	101	12 19.5	+144
18	219 03.6	133 01.8	+21 18.1	95 19.5	+20 55.2	141 34.7	+22 21.2	18 04.5	− 6 13.1	202 37.0	100	+12 33.9	+143
19	234 06.0	148 01.3	18.3	110 20.2	54.8	156 36.6	21.3	33 06.9	13.2	217 06.0	100	12 48.2	+142
20	249 08.5	163 00.8	18.5	125 21.0	54.5	171 38.6	21.3	48 09.2	13.2	231 35.0	99	13 02.4	+142
21	264 11.0	178 00.2	•• 18.7	140 21.8	•• 54.2	186 40.6	•• 21.4	63 11.5	•• 13.3	246 03.9	99	•13 16.6	+141
22	279 13.4	192 59.7	18.9	155 22.6	53.8	201 42.5	21.4	78 13.9	13.4	260 32.8	99	13 30.7	+139
23	294 15.9	207 59.2	19.1	170 23.3	53.5	216 44.5	21.4	93 16.2	13.4	275 01.7	98	13 44.6	+139
1 0	309 18.4	222 58.6	+21 19.3	185 24.1	+20 53.1	231 46.4	+22 21.5	108 18.5	− 6 13.5	289 30.5	98	+13 58.5	+138
1	324 20.8	237 58.1	19.5	200 24.9	52.8	246 48.4	21.5	123 20.8	13.6	303 59.3	97	14 12.3	+137
2	339 23.3	252 57.6	19.7	215 25.7	52.4	261 50.4	21.6	138 23.2	13.6	318 28.0	97	14 26.0	+137
3	354 25.8	267 57.0	•• 19.9	230 26.4	•• 52.1	276 52.3	•• 21.6	153 25.5	•• 13.7	332 56.7	97	•14 39.7	+135
4	9 28.2	282 56.5	20.1	245 27.2	51.7	291 54.3	21.7	168 27.8	13.8	347 25.4	96	14 53.2	+134
5	24 30.7	297 56.0	20.3	260 28.0	51.4	306 56.3	21.7	183 30.2	13.8	1 54.0	96	15 06.6	+134
6	39 33.2	312 55.4	+21 20.5	275 28.8	+20 51.0	321 58.2	+22 21.7	198 32.5	− 6 13.9	16 22.6	95	+15 20.0	+132
7	54 35.6	327 54.9	20.7	290 29.6	50.7	337 00.2	21.8	213 34.8	14.0	30 51.1	95	15 33.2	+131
8	69 38.1	342 54.4	20.8	305 30.3	50.3	352 02.1	21.8	228 37.1	14.0	45 19.6	95	15 46.3	+131
9	84 40.5	357 53.8	•• 21.0	320 31.1	•• 50.0	7 04.1	•• 21.9	243 39.5	•• 14.1	59 48.1	94	•15 59.4	+129
10	99 43.0	12 53.3	21.2	335 31.9	49.6	22 06.1	21.9	258 41.8	14.1	74 16.5	94	16 12.3	+129
11	114 45.5	27 52.8	21.4	350 32.7	49.3	37 08.0	21.9	273 44.1	14.2	88 44.9	93	16 25.2	+127
12	129 47.9	42 52.2	+21 21.6	5 33.5	+20 48.9	52 10.0	+22 22.0	288 46.4	− 6 14.3	103 13.2	93	+16 37.9	+126
13	144 50.4	57 51.7	21.8	20 34.2	48.6	67 11.9	22.0	303 48.8	14.3	117 41.5	92	16 50.5	+126
14	159 52.9	72 51.1	22.0	35 35.0	48.2	82 13.9	22.1	318 51.1	14.4	132 09.7	92	17 03.1	+124
15	174 55.3	87 50.6	•• 22.2	50 35.8	•• 47.9	97 15.9	•• 22.1	333 53.4	•• 14.5	146 37.9	91	•17 15.5	+123
16	189 57.8	102 50.1	22.3	65 36.6	47.5	112 17.8	22.1	348 55.7	14.5	161 06.0	91	17 27.8	+122
17	205 00.3	117 49.5	22.5	80 37.3	47.1	127 19.8	22.2	3 58.1	14.6	175 34.1	91	17 40.0	+121
18	220 02.7	132 49.0	+21 22.7	95 38.1	+20 46.8	142 21.8	+22 22.2	19 00.4	− 6 14.7	190 02.2	90	+17 52.1	+120
19	235 05.2	147 48.5	22.9	110 38.9	46.4	157 23.7	22.3	34 02.7	14.7	204 30.2	89	18 04.1	+118
20	250 07.7	162 47.9	23.1	125 39.7	46.1	172 25.7	22.3	49 05.1	14.8	218 58.1	89	18 15.9	+118
21	265 10.1	177 47.4	•• 23.2	140 40.5	•• 45.7	187 27.6	•• 22.3	64 07.4	•• 14.9	233 26.0	89	•18 27.7	+116
22	280 12.6	192 46.8	23.4	155 41.2	45.4	202 29.6	22.4	79 09.7	14.9	247 53.9	88	18 39.3	+116
23	295 15.0	207 46.3	23.6	170 42.0	45.0	217 31.6	22.4	94 12.0	15.0	262 21.7	87	18 50.9	+114
24	310 17.5	222 45.8	+21 23.8	185 42.8	+20 44.7	232 33.5	+22 22.5	109 14.4	− 6 15.1	276 49.4	87	+19 02.3	+112
code	−	− 5	+ 2	+ 8	− 4	+ 20	0	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
30 h 0	178 24.8	+18 38.8
1	193 24.9	38.2
2	208 24.9	37.6
3	223 24.9	37.0
4	238 24.9	36.4
5	253 24.9	35.8
6	268 25.0	+18 35.2
7	283 25.0	34.6
8	298 25.0	34.0
9	313 25.0	33.4
10	328 25.1	32.7
11	343 25.1	32.1
12	358 25.1	+18 31.5
13	13 25.1	30.9
14	28 25.2	30.3
15	43 25.2	29.7
16	58 25.2	29.1
17	73 25.2	28.5
18	88 25.3	+18 27.9
19	103 25.3	27.3
20	118 25.3	26.7
21	133 25.3	26.1
22	148 25.4	25.5
23	163 25.4	24.9
31 0	178 25.4	+18 24.3
1	193 25.5	23.6
2	208 25.5	23.0
3	223 25.5	22.4
4	238 25.5	21.8
5	253 25.6	21.2
6	268 25.6	+18 20.6
7	283 25.6	20.0
8	298 25.7	19.4
9	313 25.7	18.7
10	328 25.7	18.1
11	343 25.8	17.5
12	358 25.8	+18 16.9
13	13 25.8	16.3
14	28 25.8	15.7
15	43 25.9	15.0
16	58 25.9	14.4
17	73 25.9	13.8
18	88 26.0	+18 13.2
19	103 26.0	12.6
20	118 26.0	12.0
21	133 26.1	11.3
22	148 26.1	10.7
23	163 26.1	10.1
1 0	178 26.2	+18 09.5
1	193 26.2	08.8
2	208 26.2	08.2
3	223 26.3	07.6
4	238 26.3	07.0
5	253 26.3	06.3
6	268 26.4	+18 05.7
7	283 26.4	05.1
8	298 26.5	04.5
9	313 26.5	03.8
10	328 26.5	03.2
11	343 26.6	02.6
12	358 26.6	+18 02.0
13	13 26.6	01.3
14	28 26.7	00.7
15	43 26.7	+18 00.1
16	58 26.8	17 59.4
17	73 26.8	58.8
18	88 26.8	+17 58.2
19	103 26.9	57.5
20	118 26.9	56.9
21	133 26.9	56.3
22	148 27.0	55.6
23	163 27.0	55.0
24	178 27.1	+17 54.4
code	—	−6

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.3	−40 29.0
5	Achernar	335 59.8	−57 27.9
30	Acrux	174 00.2	−62 50.9
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.1	+16 25.2
32	Alioth	167 00.0	+56 12.9
34	Alkaid	153 34.1	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.2	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.9	+28 50.1
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.6	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.6	+19 25.5
43	Atria	109 03.1	−68 57.1
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.7
16	Betelg'se	271 50.2	+ 7 24.1
17	Canopus	264 16.6	−52 39.9
12	Capella	281 41.2	+45 57.2
53	Deneb	50 01.7	+45 06.9
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.7	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.7	+28 34.3
47	Eltanin	91 06.6	+51 29.7
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.5	−56 51.5
29	Gienah	176 38.8	−17 17.2
35	Hadar	149 51.9	−60 09.4
6	Hamal	328 51.5	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.4	+74 20.9
57	Markab	14 22.8	+14 57.4
8	Menkar	315 02.1	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 44.9	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.4	− 8 15.0
38	Rigil Kent.	140 53.3	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.7	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.7
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.1	−15 51.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 30 h m	31 h m	1 h m	2 h m
72	▭	▭	20 17	19 36	18 01	▭
70	1 14	////	20 27	19 58	19 11	▭
68	2 08	////	20 35	20 16	19 48	▭
66	2 40	////	20 42	20 30	20 15	19 49
64	3 04	////	20 47	20 42	20 36	20 28
62	3 22	////	20 52	20 52	20 52	20 55
60	3 37	////	20 57	21 01	21 06	21 17
58	3 50	////	21 01	21 08	21 19	21 34
56	4 01	////	21 04	21 15	21 29	21 49
54	4 11	////	21 07	21 21	21 39	22 02
52	4 20	1 15	21 10	21 27	21 47	22 13
50	4 27	1 47	21 13	21 32	21 54	22 23
45	4 44	2 36	21 19	21 43	22 11	22 44
40	4 57	3 07	21 23	21 52	22 24	23 01
35	5 08	3 30	21 27	22 00	22 35	23 16
30	5 18	3 48	21 31	22 07	22 45	23 28
20	5 35	4 15	21 38	22 19	23 03	23 50
10	5 49	4 34	21 43	22 30	23 18	24 09
0	6 03	4 50	21 49	22 40	23 32	24 27
10	6 16	5 03	21 54	22 50	23 47	24 45
20	6 30	5 15	22 00	23 01	24 02	0 02
30	6 46	5 24	22 07	23 14	24 20	0 20
35	6 55	5 29	22 11	23 21	24 31	0 31
40	7 06	5 33	22 16	23 30	24 43	0 43
45	7 18	5 38	22 21	23 40	24 57	0 57
50	7 33	5 42	22 27	23 52	25 15	1 15
52	7 40	5 44	22 30	23 57	25 23	1 23
54	7 48	5 45	22 34	24 04	0 04	1 33
56	7 56	5 46	22 37	24 11	0 11	1 43
58	8 06	5 48	22 41	24 18	0 18	1 55
60	8 17	5 50	22 46	24 27	0 27	2 10
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 30 h m	31 h m	1 h m	2 h m
72	▭	▭	10 18	12 48	16 13	▭
70	22 50	////	10 11	12 28	15 05	▭
68	22 00	////	10 06	12 13	14 29	▭
66	21 29	////	10 02	12 00	14 04	16 22
64	21 06	////	9 58	11 50	13 44	15 44
62	20 48	////	9 55	11 41	13 28	15 18
60	20 34	////	9 53	11 34	13 15	14 57
58	20 21	////	9 50	11 27	13 04	14 40
56	20 10	////	9 48	11 21	12 54	14 26
54	20 01	////	9 46	11 16	12 46	14 14
52	19 52	22 52	9 45	11 12	12 38	14 03
50	19 44	22 21	9 43	11 07	12 31	13 54
45	19 28	21 34	9 40	10 58	12 16	13 34
40	19 15	21 04	9 37	10 51	12 04	13 17
35	19 04	20 42	9 35	10 44	11 54	13 04
30	18 54	20 24	9 32	10 39	11 45	12 52
20	18 38	19 58	9 29	10 29	11 30	12 32
10	18 23	19 38	9 25	10 21	11 17	12 14
0	18 10	19 22	9 22	10 13	11 05	11 58
10	17 57	19 10	9 19	10 05	10 52	11 42
20	17 43	18 59	9 16	9 57	10 39	11 25
30	17 27	18 49	9 12	9 47	10 24	11 05
35	17 18	18 45	9 10	9 42	10 16	10 53
40	17 07	18 41	9 08	9 36	10 06	10 40
45	16 55	18 37	9 05	9 28	9 54	10 25
50	16 40	18 33	9 02	9 20	9 40	10 06
52	16 33	18 31	9 00	9 16	9 34	9 57
54	16 25	18 29	8 59	9 12	9 27	9 47
56	16 17	18 28	8 57	9 07	9 19	9 35
58	16 07	18 27	8 55	9 02	9 10	9 23
60	15 56	18 25	8 53	8 56	9 00	9 08
S						

GMT h	Equation of Time (App.—Mean) 30 m s	31 m s	1 m s
0	− 6 20.7	− 6 18.3	− 6 15.4
6	− 6 20.2	− 6 17.7	− 6 14.5
12	− 6 19.6	− 6 16.9	− 6 13.7
18	− 6 19.0	− 6 16.2	− 6 12.8
24	− 6 18.3	− 6 15.4	− 6 11.8

GMT of Transit
Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
30	3 11	9 07	11 40	8 38	16 52
31	4 01	9 08	11 39	8 35	16 48
1	4 52	9 08	11 38	8 32	16 44
2	5 45	9 09	11 37	8 29	16 41

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb
Add

Alt. °	30 ′	31 ′	1 ′
0	19.5	18.9	18.1
4	19.5	18.8	18.1
8	19.5	18.8	18.1
12	19.4	18.8	18.0
16	19.3	18.7	18.0
20	19.3	18.7	18.0
24	19.2	18.6	17.9
28	19.1	18.5	17.8
32	19.0	18.4	17.8
36	18.8	18.3	17.7
40	18.7	18.2	17.6
44	18.5	18.1	17.5
48	18.4	17.9	17.4
52	18.2	17.8	17.3
56	18.0	17.6	17.2
60	17.9	17.5	17.0
64	17.7	17.3	16.9
68	17.5	17.1	16.8
72	17.2	17.0	16.6
76	17.0	16.8	16.5
80	16.8	16.6	16.4
84	16.6	16.4	16.2
88	16.4	16.3	16.1
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt. °	30 ′	31 ′	1 ′
0	13.3	13.7	14.1
4	13.3	13.7	14.1
8	13.3	13.7	14.1
12	13.4	13.7	14.2
16	13.4	13.8	14.2
20	13.5	13.8	14.2
24	13.6	13.9	14.3
28	13.7	14.0	14.4
32	13.8	14.1	14.4
36	14.0	14.2	14.5
40	14.1	14.3	14.6
44	14.2	14.5	14.7
48	14.4	14.6	14.8
52	14.6	14.7	14.9
56	14.8	14.9	15.0
60	14.9	15.0	15.2
64	15.1	15.2	15.3
68	15.3	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	16.0	15.9	15.8
84	16.2	16.1	16.0
88	16.3	16.2	16.1
90			

Subtract from table, back cover

918768°—52——10

GMT	♈ GHA	VENUS −3.6 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
2 h 0	310 17.5	222 45.8	+21 23.8	185 42.8	+20 44.7	232 33.5	+22 22.5	109 14.4	− 6 15.1	276 49.4	87	+19 02.3	+112
1	325 20.0	237 45.2	23.9	200 43.6	44.3	247 35.5	22.5	124 16.7	15.1	291 17.1	87	19 13.5	+112
2	340 22.4	252 44.7	24.1	215 44.4	44.0	262 37.5	22.5	139 19.0	15.2	305 44.8	86	19 24.7	+111
3	355 24.9	267 44.1	•• 24.3	230 45.1	•• 43.6	277 39.4	•• 22.6	154 21.3	•• 15.3	320 12.4	86	•19 35.8	+109
4	10 27.4	282 43.6	24.5	245 45.9	43.3	292 41.4	22.6	169 23.6	15.3	334 40.0	85	19 46.7	+108
5	25 29.8	297 43.0	24.6	260 46.7	42.9	307 43.4	22.7	184 26.0	15.4	349 07.5	85	19 57.5	+107
6	40 32.3	312 42.5	+21 24.8	275 47.5	+20 42.5	322 45.3	+22 22.7	199 28.3	− 6 15.5	3 35.0	84	+20 08.2	+105
7	55 34.8	327 41.9	25.0	290 48.3	42.2	337 47.3	22.7	214 30.6	15.5	18 02.4	84	20 18.7	+105
8	70 37.2	342 41.4	25.2	305 49.1	41.8	352 49.3	22.8	229 32.9	15.6	32 29.8	83	20 29.2	+103
9	85 39.7	357 40.9	•• 25.3	320 49.8	•• 41.5	7 51.2	•• 22.8	244 35.3	•• 15.7	46 57.1	83	•20 39.5	+101
10	100 42.2	12 40.3	25.5	335 50.6	41.1	22 53.2	22.9	259 37.6	15.7	61 24.4	82	20 49.6	+101
11	115 44.6	27 39.8	25.7	350 51.4	40.8	37 55.2	22.9	274 39.9	15.8	75 51.6	82	20 59.7	+ 99
12	130 47.1	42 39.2	+21 25.8	5 52.2	+20 40.4	52 57.1	+22 22.9	289 42.2	− 6 15.9	90 18.8	81	+21 09.6	+ 98
13	145 49.5	57 38.7	26.0	20 53.0	40.0	67 59.1	23.0	304 44.6	15.9	104 45.9	81	21 19.4	+ 96
14	160 52.0	72 38.1	26.1	35 53.8	39.7	83 01.1	23.0	319 46.9	16.0	119 13.0	81	21 29.0	+ 96
15	175 54.5	87 37.6	•• 26.3	50 54.5	•• 39.3	98 03.0	•• 23.1	334 49.2	•• 16.1	133 40.1	80	•21 38.6	+ 93
16	190 56.9	102 37.0	26.5	65 55.3	39.0	113 05.0	23.1	349 51.5	16.1	148 07.1	79	21 47.9	+ 93
17	205 59.4	117 36.5	26.6	80 56.1	38.6	128 06.9	23.1	4 53.9	16.2	162 34.0	80	21 57.2	+ 91
18	221 01.9	132 35.9	+21 26.8	95 56.9	+20 38.2	143 08.9	+22 23.2	19 56.2	− 6 16.3	177 01.0	78	+22 06.3	+ 90
19	236 04.3	147 35.4	27.0	110 57.7	37.9	158 10.9	23.2	34 58.5	16.3	191 27.8	78	22 15.3	+ 88
20	251 06.8	162 34.8	27.1	125 58.5	37.5	173 12.9	23.3	50 00.8	16.4	205 54.6	78	22 24.1	+ 87
21	266 09.3	177 34.3	•• 27.3	140 59.2	•• 37.2	188 14.8	•• 23.3	65 03.1	•• 16.5	220 21.4	78	•22 32.8	+ 86
22	281 11.7	192 33.7	27.4	156 00.0	36.8	203 16.8	23.3	80 05.5	16.5	234 48.2	77	22 41.4	+ 84
23	296 14.2	207 33.2	27.6	171 00.8	36.5	218 18.8	23.4	95 07.8	16.6	249 14.9	76	22 49.8	+ 83
3 0	311 16.7	222 32.6	+21 27.7	186 01.6	+20 36.1	233 20.7	+22 23.4	110 10.1	− 6 16.7	263 41.5	76	+22 58.1	+ 82
1	326 19.1	237 32.1	27.9	201 02.4	35.7	248 22.7	23.4	125 12.4	16.7	278 08.1	76	23 06.3	+ 80
2	341 21.6	252 31.5	28.0	216 03.2	35.4	263 24.7	23.5	140 14.8	16.8	292 34.7	75	23 14.3	+ 78
3	356 24.0	267 31.0	•• 28.2	231 03.9	•• 35.0	278 26.6	•• 23.5	155 17.1	•• 16.9	307 01.2	75	•23 22.1	+ 77
4	11 26.5	282 30.4	28.3	246 04.7	34.6	293 28.6	23.6	170 19.4	16.9	321 27.7	75	23 29.8	+ 76
5	26 29.0	297 29.9	28.5	261 05.5	34.3	308 30.6	23.6	185 21.7	17.0	335 54.2	74	23 37.4	+ 74
6	41 31.4	312 29.3	+21 28.6	276 06.3	+20 33.9	323 32.5	+22 23.6	200 24.0	− 6 17.1	350 20.6	74	+23 44.8	+ 73
7	56 33.9	327 28.8	28.8	291 07.1	33.6	338 34.5	23.7	215 26.4	17.1	4 47.0	73	23 52.1	+ 72
8	71 36.4	342 28.2	28.9	306 07.9	33.2	353 36.5	23.7	230 28.7	17.2	19 13.3	73	23 59.3	+ 69
9	86 38.8	357 27.6	•• 29.1	321 08.7	•• 32.8	8 38.4	•• 23.8	245 31.0	•• 17.3	33 39.6	73	•24 06.2	+ 69
10	101 41.3	12 27.1	29.2	336 09.4	32.5	23 40.4	23.8	260 33.3	17.3	48 05.9	72	24 13.1	+ 67
11	116 43.8	27 26.5	29.4	351 10.2	32.1	38 42.4	23.8	275 35.6	17.4	62 32.1	73	24 19.8	+ 65
12	131 46.2	42 26.0	+21 29.5	6 11.0	+20 31.7	53 44.3	+22 23.9	290 38.0	− 6 17.5	76 58.4	72	+24 26.3	+ 64
13	146 48.7	57 25.4	29.7	21 11.8	31.4	68 46.3	23.9	305 40.3	17.5	91 24.6	71	24 32.7	+ 62
14	161 51.1	72 24.9	29.8	36 12.6	31.0	83 48.3	24.0	320 42.6	17.6	105 50.7	71	24 38.9	+ 61
15	176 53.6	87 24.3	•• 30.0	51 13.4	•• 30.7	98 50.3	•• 24.0	335 44.9	•• 17.7	120 16.8	71	•24 45.0	+ 60
16	191 56.1	102 23.7	30.1	66 14.2	30.3	113 52.2	24.0	350 47.2	17.7	134 42.9	71	24 51.0	+ 58
17	206 58.5	117 23.2	30.2	81 15.0	29.9	128 54.2	24.1	5 49.6	17.8	149 09.0	70	24 56.8	+ 56
18	222 01.0	132 22.6	+21 30.4	96 15.7	+20 29.6	143 56.2	+22 24.1	20 51.9	− 6 17.9	163 35.0	71	+25 02.4	+ 55
19	237 03.5	147 22.1	30.5	111 16.5	29.2	158 58.1	24.1	35 54.2	17.9	178 01.1	70	25 07.9	+ 53
20	252 05.9	162 21.5	30.6	126 17.3	28.8	174 00.1	24.2	50 56.5	18.0	192 27.1	69	25 13.2	+ 52
21	267 08.4	177 21.0	•• 30.8	141 18.1	•• 28.5	189 02.1	•• 24.2	65 58.8	•• 18.1	206 53.0	70	•25 18.4	+ 50
22	282 10.9	192 20.4	30.9	156 18.9	28.1	204 04.1	24.3	81 01.2	18.1	221 19.0	69	25 23.4	+ 49
23	297 13.3	207 19.8	31.1	171 19.7	27.7	219 06.0	24.3	96 03.5	18.2	235 44.9	69	25 28.3	+ 47
4 0	312 15.8	222 19.3	+21 31.2	186 20.5	+20 27.4	234 08.0	+22 24.3	111 05.8	− 6 18.3	250 10.8	69	+25 33.0	+ 45
1	327 18.3	237 18.7	31.3	201 21.3	27.0	249 10.0	24.4	126 08.1	18.3	264 36.7	69	25 37.5	+ 44
2	342 20.7	252 18.2	31.5	216 22.0	26.6	264 11.9	24.4	141 10.4	18.4	279 02.6	69	25 41.9	+ 43
3	357 23.2	267 17.6	•• 31.6	231 22.8	•• 26.3	279 13.9	•• 24.4	156 12.7	•• 18.5	293 28.5	69	•25 46.2	+ 41
4	12 25.6	282 17.0	31.7	246 23.6	25.9	294 15.9	24.5	171 15.1	18.6	307 54.4	68	25 50.3	+ 39
5	27 28.1	297 16.5	31.8	261 24.4	25.5	309 17.9	24.5	186 17.4	18.6	322 20.2	69	25 54.2	+ 38
6	42 30.6	312 15.9	+21 32.0	276 25.2	+20 25.2	324 19.8	+22 24.6	201 19.7	− 6 18.7	336 46.1	68	+25 58.0	+ 36
7	57 33.0	327 15.3	32.1	291 26.0	24.8	339 21.8	24.6	216 22.0	18.8	351 11.9	68	26 01.6	+ 35
8	72 35.5	342 14.8	32.2	306 26.8	24.4	354 23.8	24.6	231 24.3	18.8	5 37.7	68	26 05.1	+ 33
9	87 38.0	357 14.2	•• 32.3	321 27.6	•• 24.0	9 25.7	•• 24.7	246 26.6	•• 18.9	20 03.5	68	•26 08.4	+ 31
10	102 40.4	12 13.6	32.5	336 28.4	23.7	24 27.7	24.7	261 29.0	19.0	34 29.3	69	26 11.5	+ 30
11	117 42.9	27 13.1	32.6	351 29.1	23.3	39 29.7	24.8	276 31.3	19.0	48 55.2	68	26 14.5	+ 28
12	132 45.4	42 12.5	+21 32.7	6 29.9	+20 22.9	54 31.7	+22 24.8	291 33.6	− 6 19.1	63 21.0	68	+26 17.3	+ 27
13	147 47.8	57 12.0	32.8	21 30.7	22.6	69 33.6	24.8	306 35.9	19.2	77 46.8	68	26 20.0	+ 25
14	162 50.3	72 11.4	33.0	36 31.5	22.2	84 35.6	24.9	321 38.2	19.2	92 12.6	68	26 22.5	+ 24
15	177 52.8	87 10.8	•• 33.1	51 32.3	•• 21.8	99 37.6	•• 24.9	336 40.6	•• 19.3	106 38.4	68	•26 24.9	+ 22
16	192 55.2	102 10.3	33.2	66 33.1	21.5	114 39.6	24.9	351 42.9	19.4	121 04.2	69	26 27.1	+ 21
17	207 57.7	117 09.7	33.3	81 33.9	21.1	129 41.5	25.0	6 45.2	19.4	135 30.1	68	26 29.2	+ 19
18	223 00.1	132 09.1	+21 33.4	96 34.7	+20 20.7	144 43.5	+22 25.0	21 47.5	− 6 19.5	149 55.9	68	+26 31.1	+ 17
19	238 02.6	147 08.6	33.5	111 35.5	20.3	159 45.5	25.1	36 49.8	19.6	164 21.7	69	26 32.8	+ 16
20	253 05.1	162 08.0	33.7	126 36.3	20.0	174 47.5	25.1	51 52.1	19.7	178 47.6	69	26 34.4	+ 14
21	268 07.5	177 07.4	•• 33.8	141 37.1	•• 19.6	189 49.4	•• 25.1	66 54.4	•• 19.7	193 13.5	68	•26 35.8	+ 12
22	283 10.0	192 06.8	33.9	156 37.9	19.2	204 51.4	25.2	81 56.8	19.8	207 39.3	69	26 37.0	+ 12
23	298 12.5	207 06.3	34.0	171 38.6	18.9	219 53.4	25.2	96 59.1	19.9	222 05.2	70	26 38.2	+ 9
24	313 14.9	222 05.7	+21 34.1	186 39.4	+20 18.5	234 55.4	+22 25.2	112 01.4	− 6 19.9	236 31.2	69	+26 39.1	+ 8
code	−	− 6	+ 2	+ 8	− 3	+ 20	0	+ 23	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
2 0	178 27.1	+17 54.4
1	193 27.1	53.7
2	208 27.2	53.1
3	223 27.2	52.5
4	238 27.2	51.8
5	253 27.3	51.2
6	268 27.3	+17 50.6
7	283 27.4	49.9
8	298 27.4	49.3
9	313 27.4	48.6
10	328 27.5	48.0
11	343 27.5	47.4
12	358 27.6	+17 46.7
13	13 27.6	46.1
14	28 27.7	45.4
15	43 27.7	44.8
16	58 27.7	44.2
17	73 27.8	43.5
18	88 27.8	+17 42.9
19	103 27.9	42.2
20	118 27.9	41.6
21	133 28.0	40.9
22	148 28.0	40.3
23	163 28.1	39.6
3 0	178 28.1	+17 39.0
1	193 28.2	38.3
2	208 28.2	37.7
3	223 28.2	37.0
4	238 28.3	36.4
5	253 28.3	35.7
6	268 28.4	+17 35.1
7	283 28.4	34.4
8	298 28.5	33.8
9	313 28.5	33.1
10	328 28.6	32.5
11	343 28.6	31.8
12	358 28.7	+17 31.2
13	13 28.7	30.5
14	28 28.8	29.9
15	43 28.8	29.2
16	58 28.9	28.6
17	73 28.9	27.9
18	88 29.0	+17 27.3
19	103 29.0	26.6
20	118 29.1	25.9
21	133 29.1	25.3
22	148 29.2	24.6
23	163 29.2	24.0
4 0	178 29.3	+17 23.3
1	193 29.3	22.7
2	208 29.4	22.0
3	223 29.5	21.3
4	238 29.5	20.7
5	253 29.6	20.0
6	268 29.6	+17 19.4
7	283 29.7	18.7
8	298 29.7	18.0
9	313 29.8	17.4
10	328 29.8	16.7
11	343 29.9	16.0
12	358 29.9	+17 15.4
13	13 30.0	14.7
14	28 30.0	14.0
15	43 30.1	13.4
16	58 30.2	12.7
17	73 30.2	12.0
18	88 30.3	+17 11.4
19	103 30.3	10.7
20	118 30.4	10.0
21	133 30.4	09.4
22	148 30.5	08.7
23	163 30.6	08.0
24	178 30.6	+17 07.4
code	−	− 7

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.3	−40 29.0
5	Achernar	335 59.7	−57 27.9
30	Acrux	174 00.2	−62 50.8
19	Adhara	255 48.2	−28 54.3
10	Aldebaran	291 41.1	+16 25.2
32	Alioth	167 00.1	+56 12.9
34	Alkaid	153 34.1	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.2	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.8	+28 50.1
51	Altair	62 51.7	+ 8 44.7
2	Ankaa	353 59.5	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.1	−68 57.1
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.7
16	Betelg'se	271 50.1	+ 7 24.2
17	Canopus	264 16.6	−52 39.9
12	Capella	281 41.1	+45 57.2
53	Deneb	50 01.7	+45 06.9
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.7	−18 14.2
27	Dubhe	194 46.9	+62 00.3
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 06.6	+51 29.8
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.5	−56 51.5
29	Gienah	176 38.8	−17 17.2
35	Hadar	149 52.0	−60 09.4
6	Hamal	328 51.5	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.5	+74 20.9
57	Markab	14 22.8	+14 57.4
8	Menkar	315 02.0	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 44.9	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.4	− 8 15.0
38	Rigil Kent.	140 53.4	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.7	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 2	3	4
h	m s	m s	m s
0	− 6 11.8	− 6 07.7	− 6 02.9
6	− 6 10.8	− 6 06.5	− 6 01.7
12	− 6 09.8	− 6 05.4	− 6 00.4
18	− 6 08.8	− 6 04.2	− 5 59.0
24	− 6 07.7	− 6 02.9	− 5 57.6

Lat.	Sunrise	Twlt. begins	Moonrise 2	3	4	5
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	▭	▭	▭
70	1 41	////	▭	▭	▭	▭
68	2 24	////	▭	▭	▭	▭
66	2 52	////	19 49	▭	▭	▭
64	3 13	////	20 28	20 15	▭	▭
62	3 30	////	20 55	21 04	21 30	22 34
60	3 45	////	21 17	21 35	22 11	23 13
58	3 57	////	21 34	21 59	22 39	23 40
56	4 07	////	21 49	22 18	23 01	24 01
54	4 16	0 39	22 02	22 34	23 19	24 19
52	4 24	1 29	22 13	22 48	23 34	24 34
50	4 32	1 57	22 23	23 00	23 48	24 47
45	4 47	2 42	22 44	23 25	24 15	0 15
40	5 00	3 11	23 01	23 45	24 36	0 36
35	5 11	3 33	23 16	24 02	0 02	0 54
30	5 20	3 50	23 28	24 16	0 16	1 10
20	5 36	4 17	23 50	24 41	0 41	1 36
10	5 50	4 36	24 09	0 09	1 03	1 59
0	6 03	4 51	24 27	0 27	1 23	2 20
10	6 15	5 03	24 45	0 45	1 43	2 41
20	6 29	5 13	0 02	1 04	2 05	3 04
30	6 44	5 23	0 20	1 26	2 30	3 30
35	6 53	5 27	0 31	1 40	2 45	3 46
40	7 03	5 31	0 43	1 55	3 03	4 04
45	7 15	5 35	0 57	2 13	3 24	4 26
50	7 29	5 38	1 15	2 36	3 50	4 53
52	7 35	5 39	1 23	2 47	4 03	5 07
54	7 43	5 41	1 33	2 59	4 18	5 23
56	7 51	5 42	1 43	3 14	4 35	5 41
58	8 00	5 43	1 55	3 30	4 56	6 04
60	8 11	5 45	2 10	3 51	5 23	6 33
S						

Lat.	Sunset	Twlt. ends	Moonset 2	3	4	5
N °	h m	h m	h m	h m	h m	h m
72	▭	▭	▭	▭	▭	▭
70	22 25	////	▭	▭	▭	▭
68	21 45	////	▭	▭	▭	▭
66	21 17	////	16 22	▭	▭	▭
64	20 57	////	15 44	17 54	▭	▭
62	20 40	////	15 18	17 05	18 38	19 32
60	20 26	////	14 57	16 35	17 57	18 53
58	20 14	////	14 40	16 11	17 29	18 25
56	20 04	////	14 26	15 53	17 07	18 04
54	19 55	23 22	14 14	15 37	16 49	17 46
52	19 47	22 38	14 03	15 24	16 34	17 31
50	19 40	22 11	13 54	15 12	16 21	17 18
45	19 24	21 28	13 34	14 47	15 54	16 51
40	19 12	20 59	13 17	14 28	15 32	16 30
35	19 01	20 38	13 04	14 11	15 15	16 12
30	18 52	20 21	12 52	13 57	14 59	15 56
20	18 36	19 55	12 32	13 33	14 33	15 30
10	18 22	19 36	12 14	13 13	14 11	15 08
0	18 10	19 22	11 58	12 54	13 50	14 47
10	17 57	19 10	11 42	12 34	13 29	14 26
20	17 44	19 00	11 25	12 14	13 07	14 03
30	17 29	18 51	11 05	11 50	12 41	13 37
35	17 20	18 47	10 53	11 36	12 26	13 21
40	17 10	18 43	10 40	11 20	12 08	13 03
45	16 58	18 39	10 25	11 02	11 47	12 41
50	16 44	18 36	10 06	10 38	11 20	12 14
52	16 38	18 35	9 57	10 26	11 07	12 00
54	16 30	18 33	9 47	10 14	10 52	11 45
56	16 22	18 32	9 35	9 59	10 34	11 26
58	16 13	18 31	9 23	9 42	10 13	11 03
60	16 03	18 31	9 08	9 20	9 46	10 34
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
2	5 45	9 09	11 37	8 29	16 41
3	6 40	9 10	11 35	8 26	16 37
4	7 37	9 11	11 34	8 22	16 33
5	8 33	9 12	11 33	8 19	16 29

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	2	3	4
°	′	′	′
0	17.3	16.6	15.8
4	17.3	16.6	15.8
8	17.3	16.6	15.8
12	17.3	16.5	15.8
16	17.3	16.5	15.8
20	17.2	16.5	15.8
24	17.2	16.5	15.8
28	17.1	16.5	15.8
32	17.1	16.4	15.8
36	17.0	16.4	15.8
40	17.0	16.4	15.8
44	16.9	16.3	15.7
48	16.8	16.3	15.7
52	16.8	16.2	15.7
56	16.7	16.2	15.7
60	16.6	16.1	15.7
64	16.5	16.1	15.7
68	16.4	16.0	15.7
72	16.3	16.0	15.7
76	16.2	15.9	15.6
80	16.1	15.9	15.6
84	16.0	15.8	15.6
88	16.0	15.8	15.6
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	2	3	4
°	′	′	′
0	14.5	15.0	15.4
4	14.5	15.0	15.4
8	14.6	15.0	15.4
12	14.6	15.0	15.4
16	14.6	15.0	15.4
20	14.6	15.0	15.4
24	14.7	15.0	15.4
28	14.7	15.1	15.4
32	14.8	15.1	15.4
36	14.8	15.1	15.4
40	14.9	15.2	15.5
44	15.0	15.2	15.5
48	15.0	15.3	15.5
52	15.1	15.3	15.5
56	15.2	15.3	15.5
60	15.3	15.4	15.5
64	15.4	15.4	15.5
68	15.5	15.5	15.5
72	15.5	15.5	15.6
76	15.6	15.6	15.6
80	15.7	15.7	15.6
84	15.8	15.7	15.6
88	15.9	15.8	15.6
90			

Subtract from table, back cover

Last Quarter 2

GMT	♈ GHA	VENUS −3.6 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −1.6 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
5 0	313 14.9	222 05.7	+21 34.1	186 39.4	+20 18.5	234 55.4	+22 25.2	112 01.4	− 6 19.9	236 31.2	69	+26 39.1	+ 8
1	328 17.4	237 05.1	34.2	201 40.2	18.1	249 57.3	25.3	127 03.7	20.0	250 57.1	69	26 39.9	+ 6
2	343 19.9	252 04.6	34.3	216 41.0	17.7	264 59.3	25.3	142 06.0	20.1	265 23.0	70	26 40.5	+ 5
3	358 22.3	267 04.0	•• 34.4	231 41.8	•• 17.4	280 01.3	•• 25.3	157 08.3	•• 20.1	279 49.0	70	•26 41.0	+ 3
4	13 24.8	282 03.4	34.5	246 42.6	17.0	295 03.3	25.4	172 10.7	20.2	294 15.0	71	26 41.3	+ 2
5	28 27.3	297 02.9	34.6	261 43.4	16.6	310 05.2	25.4	187 13.0	20.3	308 41.1	70	26 41.5	0
6	43 29.7	312 02.3	+21 34.8	276 44.2	+20 16.2	325 07.2	+22 25.5	202 15.3	− 6 20.3	323 07.1	71	+26 41.5	− 1
7	58 32.2	327 01.7	34.9	291 45.0	15.9	340 09.2	25.5	217 17.6	20.4	337 33.2	71	26 41.4	− 3
8	73 34.6	342 01.1	35.0	306 45.8	15.5	355 11.2	25.5	232 19.9	20.5	351 59.3	71	26 41.1	− 5
9	88 37.1	357 00.6	•• 35.1	321 46.6	•• 15.1	10 13.2	•• 25.6	247 22.2	•• 20.6	6 25.4	72	•26 40.6	− 6
10	103 39.6	12 00.0	35.2	336 47.4	14.7	25 15.1	25.6	262 24.5	20.6	20 51.6	72	26 40.0	− 7
11	118 42.0	26 59.4	35.3	351 48.2	14.4	40 17.1	25.6	277 26.8	20.7	35 17.8	73	26 39.3	− 9
12	133 44.5	41 58.9	+21 35.4	6 49.0	+20 14.0	55 19.1	+22 25.7	292 29.2	− 6 20.8	49 44.1	73	+26 38.4	− 11
13	148 47.0	56 58.3	35.5	21 49.8	13.6	70 21.1	25.7	307 31.5	20.8	64 10.4	73	26 37.3	− 12
14	163 49.4	71 57.7	35.6	36 50.6	13.2	85 23.0	25.8	322 33.8	20.9	78 36.7	73	26 36.1	− 13
15	178 51.9	86 57.1	•• 35.7	51 51.3	•• 12.9	100 25.0	•• 25.8	337 36.1	•• 21.0	93 03.0	74	•26 34.8	− 16
16	193 54.4	101 56.6	35.8	66 52.1	12.5	115 27.0	25.8	352 38.4	21.0	107 29.4	75	26 33.2	− 16
17	208 56.8	116 56.0	35.9	81 52.9	12.1	130 29.0	25.9	7 40.7	21.1	121 55.9	75	26 31.6	− 18
18	223 59.3	131 55.4	+21 36.0	96 53.7	+20 11.7	145 31.0	+22 25.9	22 43.0	− 6 21.2	136 22.4	75	+26 29.8	− 20
19	239 01.7	146 54.8	36.0	111 54.5	11.4	160 32.9	25.9	37 45.4	21.3	150 48.9	76	26 27.8	− 21
20	254 04.2	161 54.3	36.1	126 55.3	11.0	175 34.9	26.0	52 47.7	21.3	165 15.5	76	26 25.7	− 22
21	269 06.7	176 53.7	•• 36.2	141 56.1	•• 10.6	190 36.9	•• 26.0	67 50.0	•• 21.4	179 42.1	77	•26 23.5	− 24
22	284 09.1	191 53.1	36.3	156 56.9	10.2	205 38.9	26.0	82 52.3	21.5	194 08.8	77	26 21.1	− 26
23	299 11.6	206 52.5	36.4	171 57.7	09.9	220 40.9	26.1	97 54.6	21.5	208 35.5	78	26 18.5	− 27
6 0	314 14.1	221 52.0	+21 36.5	186 58.5	+20 09.5	235 42.8	+22 26.1	112 56.9	− 6 21.6	223 02.3	78	+26 15.8	− 28
1	329 16.5	236 51.4	36.6	201 59.3	09.1	250 44.8	26.2	127 59.2	21.7	237 29.1	79	26 13.0	− 30
2	344 19.0	251 50.8	36.7	217 00.1	08.7	265 46.8	26.2	143 01.5	21.8	251 56.0	80	26 10.0	− 31
3	359 21.5	266 50.2	•• 36.8	232 00.9	•• 08.3	280 48.8	•• 26.2	158 03.9	•• 21.8	266 23.0	80	•26 06.9	− 33
4	14 23.9	281 49.6	36.8	247 01.7	08.0	295 50.8	26.3	173 06.2	21.9	280 50.0	80	26 03.6	− 34
5	29 26.4	296 49.1	36.9	262 02.5	07.6	310 52.7	26.3	188 08.5	22.0	295 17.0	82	26 00.2	− 36
6	44 28.9	311 48.5	+21 37.0	277 03.3	+20 07.2	325 54.7	+22 26.3	203 10.8	− 6 22.0	309 44.2	81	+25 56.6	− 36
7	59 31.3	326 47.9	37.1	292 04.1	06.8	340 56.7	26.4	218 13.1	22.1	324 11.3	83	25 53.0	− 39
8	74 33.8	341 47.3	37.2	307 04.9	06.4	355 58.7	26.4	233 15.4	22.2	338 38.6	83	25 49.1	− 39
9	89 36.2	356 46.7	•• 37.3	322 05.7	•• 06.1	11 00.7	•• 26.4	248 17.7	•• 22.2	353 05.9	84	•25 45.2	− 41
10	104 38.7	11 46.2	37.3	337 06.5	05.7	26 02.6	26.5	263 20.0	22.3	7 33.3	84	25 41.1	− 43
11	119 41.2	26 45.6	37.4	352 07.3	05.3	41 04.6	26.5	278 22.3	22.4	22 00.7	85	25 36.8	− 44
12	134 43.6	41 45.0	+21 37.5	7 08.1	+20 04.9	56 06.6	+22 26.5	293 24.7	− 6 22.5	36 28.2	86	+25 32.4	− 45
13	149 46.1	56 44.4	37.6	22 08.9	04.5	71 08.6	26.6	308 27.0	22.5	50 55.8	86	25 27.9	− 46
14	164 48.6	71 43.8	37.6	37 09.7	04.1	86 10.6	26.6	323 29.3	22.6	65 23.4	87	25 23.3	− 48
15	179 51.0	86 43.3	•• 37.7	52 10.5	•• 03.8	101 12.6	•• 26.7	338 31.6	•• 22.7	79 51.1	88	•25 18.5	− 49
16	194 53.5	101 42.7	37.8	67 11.3	03.4	116 14.5	26.7	353 33.9	22.7	94 18.9	88	25 13.6	− 51
17	209 56.0	116 42.1	37.9	82 12.1	03.0	131 16.5	26.7	8 36.2	22.8	108 46.7	90	25 08.5	− 51
18	224 58.4	131 41.5	+21 37.9	97 12.9	+20 02.6	146 18.5	+22 26.8	23 38.5	− 6 22.9	123 14.7	89	+25 03.4	− 53
19	240 00.9	146 40.9	38.0	112 13.7	02.2	161 20.5	26.8	38 40.8	23.0	137 42.6	91	24 58.1	− 55
20	255 03.4	161 40.3	38.1	127 14.5	01.9	176 22.5	26.8	53 43.1	23.0	152 10.7	91	24 52.6	− 55
21	270 05.8	176 39.8	•• 38.1	142 15.3	•• 01.5	191 24.5	•• 26.9	68 45.4	•• 23.1	166 38.8	93	•24 47.1	− 57
22	285 08.3	191 39.2	38.2	157 16.1	01.1	206 26.4	26.9	83 47.7	23.2	181 07.1	92	24 41.4	− 58
23	300 10.7	206 38.6	38.3	172 16.9	00.7	221 28.4	26.9	98 50.1	23.2	195 35.3	94	24 35.6	− 60
7 0	315 13.2	221 38.0	+21 38.3	187 17.7	+20 00.3	236 30.4	+22 27.0	113 52.4	− 6 23.3	210 03.7	94	+24 29.6	− 60
1	330 15.7	236 37.4	38.4	202 18.5	19 59.9	251 32.4	27.0	128 54.7	23.4	224 32.1	96	24 23.6	− 62
2	345 18.1	251 36.8	38.5	217 19.3	59.5	266 34.4	27.0	143 57.0	23.5	239 00.7	95	24 17.4	− 63
3	0 20.6	266 36.2	•• 38.5	232 20.1	•• 59.2	281 36.4	•• 27.1	158 59.3	•• 23.5	253 29.2	97	•24 11.1	− 64
4	15 23.1	281 35.7	38.6	247 20.9	58.8	296 38.3	27.1	174 01.6	23.6	267 57.9	98	24 04.7	− 66
5	30 25.5	296 35.1	38.7	262 21.7	58.4	311 40.3	27.1	189 03.9	23.7	282 26.7	98	23 58.1	− 66
6	45 28.0	311 34.5	+21 38.7	277 22.5	+19 58.0	326 42.3	+22 27.2	204 06.2	− 6 23.7	296 55.5	99	+23 51.5	− 68
7	60 30.5	326 33.9	38.8	292 23.3	57.6	341 44.3	27.2	219 08.5	23.8	311 24.4	100	23 44.7	− 69
8	75 32.9	341 33.3	38.8	307 24.1	57.2	356 46.3	27.3	234 10.8	23.9	325 53.4	101	23 37.8	− 70
9	90 35.4	356 32.7	•• 38.9	322 24.9	•• 56.8	11 48.3	•• 27.3	249 13.1	•• 24.0	340 22.5	101	•23 30.8	− 71
10	105 37.9	11 32.1	39.0	337 25.7	56.5	26 50.3	27.3	264 15.4	24.0	354 51.6	102	23 23.7	− 73
11	120 40.3	26 31.5	39.0	352 26.5	56.1	41 52.2	27.4	279 17.8	24.1	9 20.8	103	23 16.4	− 73
12	135 42.8	41 31.0	+21 39.1	7 27.3	+19 55.7	56 54.2	+22 27.4	294 20.1	− 6 24.2	23 50.1	104	+23 09.1	− 75
13	150 45.2	56 30.4	39.1	22 28.1	55.3	71 56.2	27.4	309 22.4	24.3	38 19.5	105	23 01.6	− 75
14	165 47.7	71 29.8	39.2	37 28.9	54.9	86 58.2	27.5	324 24.7	24.3	52 49.0	106	22 54.1	− 77
15	180 50.2	86 29.2	•• 39.2	52 29.7	•• 54.5	102 00.2	•• 27.5	339 27.0	•• 24.4	67 18.6	106	•22 46.4	− 78
16	195 52.6	101 28.6	39.3	67 30.5	54.1	117 02.2	27.5	354 29.3	24.5	81 48.2	107	22 38.6	− 79
17	210 55.1	116 28.0	39.3	82 31.3	53.7	132 04.2	27.6	9 31.6	24.5	96 17.9	108	22 30.7	− 80
18	225 57.6	131 27.4	+21 39.4	97 32.1	+19 53.4	147 06.1	+22 27.6	24 33.9	− 6 24.6	110 47.7	109	+22 22.7	− 81
19	241 00.0	146 26.8	39.4	112 32.9	53.0	162 08.1	27.6	39 36.2	24.7	125 17.6	110	22 14.6	− 82
20	256 02.5	161 26.2	39.5	127 33.7	52.6	177 10.1	27.7	54 38.5	24.8	139 47.6	110	22 06.4	− 83
21	271 05.0	176 25.7	•• 39.5	142 34.5	•• 52.2	192 12.1	•• 27.7	69 40.8	•• 24.8	154 17.6	112	•21 58.1	− 84
22	286 07.4	191 25.1	39.6	157 35.3	51.8	207 14.1	27.7	84 43.1	24.9	168 47.8	112	21 49.7	− 85
23	301 09.9	206 24.5	39.6	172 36.1	51.4	222 16.1	27.8	99 45.4	25.0	183 18.0	113	21 41.2	− 86
24	316 12.4	221 23.9	+21 39.7	187 37.0	+19 51.0	237 18.1	+22 27.8	114 47.7	− 6 25.1	197 48.3	114	+21 32.6	− 87
code	—	− 6	+ 1	+ 8	− 4	+ 20	+ 1	+ 23	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
5 0	178 30.6	+17 07.4
1	193 30.7	06.7
2	208 30.7	06.0
3	223 30.8	·· 05.3
4	238 30.9	04.7
5	253 30.9	04.0
6	268 31.0	+17 03.3
7	283 31.0	02.6
8	298 31.1	02.0
9	313 31.2	·· 01.3
10	328 31.2	17 00.6
11	343 31.3	16 59.9
12	358 31.3	+16 59.3
13	13 31.4	58.6
14	28 31.5	57.9
15	43 31.5	·· 57.2
16	58 31.6	56.6
17	73 31.7	55.9
18	88 31.7	+16 55.2
19	103 31.8	54.5
20	118 31.8	53.8
21	133 31.9	·· 53.2
22	148 32.0	52.5
23	163 32.0	51.8
6 0	178 32.1	+16 51.1
1	193 32.2	50.4
2	208 32.2	49.8
3	223 32.3	·· 49.1
4	238 32.4	48.4
5	253 32.4	47.7
6	268 32.5	+16 47.0
7	283 32.6	46.3
8	298 32.6	45.6
9	313 32.7	·· 45.0
10	328 32.8	44.3
11	343 32.8	43.6
12	358 32.9	+16 42.9
13	13 33.0	42.2
14	28 33.0	41.5
15	43 33.1	·· 40.8
16	58 33.2	40.1
17	73 33.2	39.4
18	88 33.3	+16 38.8
19	103 33.4	38.1
20	118 33.4	37.4
21	133 33.5	·· 36.7
22	148 33.6	36.0
23	163 33.7	35.3
7 0	178 33.7	+16 34.6
1	193 33.8	33.9
2	208 33.9	33.2
3	223 33.9	·· 32.5
4	238 34.0	31.8
5	253 34.1	31.1
6	268 34.2	+16 30.4
7	283 34.2	29.7
8	298 34.3	29.0
9	313 34.4	·· 28.3
10	328 34.4	27.6
11	343 34.5	26.9
12	358 34.6	+16 26.2
13	13 34.7	25.5
14	28 34.7	24.8
15	43 34.8	·· 24.1
16	58 34.9	23.4
17	73 35.0	22.7
18	88 35.0	+16 22.0
19	103 35.1	21.3
20	118 35.2	20.6
21	133 35.3	·· 19.9
22	148 35.3	19.2
23	163 35.4	18.5
24	178 35.5	+16 17.8
code	—	- 7

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.3	−40 29.0
5	Achernar	335 59.7	−57 27.9
30	Acrux	174 00.2	−62 50.8
19	Adhara	255 48.1	−28 54.3
10	Aldebaran	291 41.1	+16 25.2
32	Alioth	167 00.1	+56 12.9
34	Alkaid	153 34.2	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.1	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.8	+28 50.1
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.5	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.2	−68 57.1
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.4	+ 6 18.7
16	Betelg'se	271 50.1	+ 7 24.2
17	Canopus	264 16.5	−52 39.9
12	Capella	281 41.1	+45 57.2
53	Deneb	50 01.7	+45 06.9
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.7	−18 14.2
27	Dubhe	194 46.9	+62 00.2
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 06.6	+51 29.8
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.5	−56 51.5
29	Gienah	176 38.8	−17 17.2
35	Hadar	149 52.0	−60 09.4
6	Hamal	328 51.4	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.5	+74 20.9
57	Markab	14 22.8	+14 57.4
8	Menkar	315 02.0	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 44.8	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.4	− 8 15.0
38	Rigil Kent.	140 53.4	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.7	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.6	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 5	6	7
h	m s	m s	m s
0	− 5 57.6	− 5 51.7	− 5 45.2
6	− 5 56.2	− 5 50.2	− 5 43.5
12	− 5 54.8	− 5 48.6	− 5 41.8
18	− 5 53.3	− 5 46.9	− 5 40.0
24	− 5 51.7	− 5 45.2	− 5 38.2

Lat.	Sunrise	Twlt. begins	Moonrise 5	6	7	8
N °	h m	h m	h m	h m	h m	h m
72	0 53	////	▭	▭	▭	▭
70	2 02	////	▭	▭	▭	▭
68	2 38	////	▭	▭	23 40	26 20
66	3 03	////	▭	▭	▭	0 45
64	3 23	////	▭	23 23	25 20	1 20
62	3 39	////	22 34	24 06	0 06	1 45
60	3 52	////	23 13	24 35	0 35	2 05
58	4 03	////	23 40	24 57	0 57	2 21
56	4 13	////	24 01	0 01	1 15	2 35
54	4 21	1 05	24 19	0 19	1 30	2 47
52	4 29	1 41	24 34	0 34	1 43	2 57
50	4 36	2 06	24 47	0 47	1 54	3 06
45	4 51	2 47	0 15	1 14	2 18	3 26
40	5 03	3 16	0 36	1 35	2 37	3 42
35	5 13	3 36	0 54	1 52	2 53	3 55
30	5 22	3 53	1 10	2 07	3 07	4 06
20	5 37	4 18	1 36	2 33	3 30	4 26
10	5 50	4 36	1 59	2 55	3 50	4 43
0	6 02	4 51	2 20	3 16	4 09	4 59
10	6 14	5 03	2 41	3 36	4 28	5 15
20	6 27	5 12	3 04	3 58	4 48	5 32
30	6 42	5 20	3 30	4 24	5 11	5 51
35	6 50	5 24	3 46	4 39	5 24	6 02
40	7 00	5 28	4 04	4 56	5 40	6 15
45	7 11	5 31	4 26	5 17	5 58	6 31
50	7 24	5 34	4 53	5 43	6 21	6 49
52	7 30	5 35	5 07	5 56	6 32	6 58
54	7 37	5 36	5 23	6 11	6 44	7 07
56	7 45	5 37	5 41	6 28	6 58	7 18
58	7 54	5 38	6 04	6 48	7 15	7 31
60	8 04	5 38	6 33	7 14	7 35	7 45
S						

Lat.	Sunset	Twlt. ends	Moonset 5	6	7	8
N °	h m	h m	h m	h m	h m	h m
72	23 04	////	▭	▭	▭	22 54
70	22 04	////	▭	▭	▭	21 42
68	21 30	////	▭	▭	22 06	21 05
66	21 06	////	▭	▭	21 00	20 38
64	20 47	////	▭	20 35	20 24	20 17
62	20 31	////	19 32	19 52	19 59	20 01
60	20 18	////	18 53	19 23	19 38	19 47
58	20 07	////	18 25	19 01	19 21	19 34
56	19 58	////	18 04	18 42	19 07	19 24
54	19 49	22 59	17 46	18 27	18 55	19 15
52	19 42	22 25	17 31	18 13	18 44	19 06
50	19 35	22 01	17 18	18 02	18 34	18 59
45	19 20	21 21	16 51	17 37	18 14	18 43
40	19 09	20 55	16 30	17 18	17 57	18 30
35	18 58	20 34	16 12	17 01	17 43	18 18
30	18 50	20 18	15 56	16 47	17 31	18 08
20	18 35	19 54	15 30	16 22	17 09	17 51
10	18 21	19 35	15 08	16 01	16 51	17 36
0	18 09	19 21	14 47	15 42	16 33	17 22
10	17 57	19 09	14 26	15 22	16 16	17 08
20	17 45	19 00	14 03	15 00	15 57	16 52
30	17 30	18 52	13 37	14 36	15 36	16 35
35	17 22	18 49	13 21	14 21	15 23	16 24
40	17 12	18 45	13 03	14 04	15 08	16 12
45	17 01	18 42	12 41	13 44	14 50	15 58
50	16 48	18 39	12 14	13 18	14 28	15 41
52	16 42	18 39	12 00	13 05	14 18	15 33
54	16 35	18 37	11 45	12 51	14 06	15 24
56	16 27	18 36	11 26	12 34	13 52	15 13
58	16 19	18 36	11 03	12 14	13 36	15 01
60	16 09	18 35	10 34	11 48	13 17	14 48
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
5	8 33	9 12	11 33	8 19	16 29
6	9 29	9 13	11 32	8 16	16 26
7	10 21	9 14	11 30	8 13	16 22
8	11 11	9 15	11 29	8 10	16 18

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	5	6	7
°	′	′	′
0	15.0	14.4	13.8
4	15.0	14.4	13.8
8	15.0	14.4	13.8
12	15.1	14.4	13.8
16	15.1	14.4	13.8
20	15.1	14.5	13.9
24	15.1	14.5	13.9
28	15.1	14.5	14.0
32	15.1	14.6	14.0
36	15.1	14.6	14.1
40	15.1	14.6	14.1
44	15.2	14.7	14.2
48	15.2	14.7	14.3
52	15.2	14.8	14.3
56	15.2	14.8	14.4
60	15.3	14.9	14.5
64	15.3	14.9	14.6
68	15.3	15.0	14.7
72	15.3	15.1	14.8
76	15.4	15.1	14.9
80	15.4	15.2	15.0
84	15.4	15.2	15.1
88	15.4	15.3	15.1
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	5	6	7
°	′	′	′
0	15.8	16.2	16.6
4	15.8	16.2	16.6
8	15.8	16.2	16.5
12	15.8	16.2	16.5
16	15.8	16.2	16.5
20	15.8	16.1	16.5
24	15.8	16.1	16.4
28	15.8	16.1	16.4
32	15.8	16.1	16.3
36	15.8	16.0	16.3
40	15.7	16.0	16.2
44	15.7	15.9	16.1
48	15.7	15.9	16.1
52	15.7	15.8	16.0
56	15.7	15.8	15.9
60	15.6	15.7	15.8
64	15.6	15.7	15.7
68	15.6	15.6	15.6
72	15.6	15.6	15.6
76	15.5	15.5	15.5
80	15.5	15.4	15.4
84	15.5	15.4	15.3
88	15.4	15.3	15.2
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
8 0	316 12.4	221 23.9	+21 39.7	187 37.0	+19 51.0	237 18.1	+22 27.8	114 47.7	− 6 25.1	197 48.3	114	+21 32.6	− 87
1	331 14.8	236 23.3	39.7	202 37.8	50.6	252 20.1	27.8	129 50.0	25.1	212 18.7	115	21 23.9	− 88
2	346 17.3	251 22.7	39.7	217 38.6	50.2	267 22.1	27.9	144 52.4	25.2	226 49.2	115	21 15.1	− 88
3	1 19.7	266 22.1	•• 39.8	232 39.4	•• 49.9	282 24.0	•• 27.9	159 54.7	•• 25.3	241 19.7	116	•21 06.3	− 90
4	16 22.2	281 21.5	39.8	247 40.2	49.5	297 26.0	27.9	174 57.0	25.3	255 50.3	118	20 57.3	− 91
5	31 24.7	296 20.9	39.9	262 41.0	49.1	312 28.0	28.0	189 59.3	25.4	270 21.1	118	20 48.2	− 92
6	46 27.1	311 20.3	+21 39.9	277 41.8	+19 48.7	327 30.0	+22 28.0	205 01.6	− 6 25.5	284 51.9	119	+20 39.0	− 92
7	61 29.6	326 19.7	39.9	292 42.6	48.3	342 32.0	28.0	220 03.9	25.6	299 22.8	119	20 29.8	− 94
8	76 32.1	341 19.1	40.0	307 43.4	47.9	357 34.0	28.1	235 06.2	25.6	313 53.7	121	20 20.4	− 94
9	91 34.5	356 18.5	•• 40.0	322 44.2	•• 47.5	12 36.0	•• 28.1	250 08.5	•• 25.7	328 24.8	121	•20 11.0	− 95
10	106 37.0	11 17.9	40.0	337 45.0	47.1	27 38.0	28.1	265 10.8	25.8	342 55.9	122	20 01.5	− 96
11	121 39.5	26 17.3	40.1	352 45.8	46.7	42 40.0	28.2	280 13.1	25.9	357 27.1	123	19 51.9	− 97
12	136 41.9	41 16.8	+21 40.1	7 46.6	+19 46.3	57 41.9	+22 28.2	295 15.4	− 6 25.9	11 58.4	124	+19 42.2	− 98
13	151 44.4	56 16.2	40.1	22 47.4	45.9	72 43.9	28.3	310 17.7	26.0	26 29.8	124	19 32.4	− 99
14	166 46.8	71 15.6	40.2	37 48.2	45.5	87 45.9	28.3	325 20.0	26.1	41 01.2	126	19 22.5	− 99
15	181 49.3	86 15.0	•• 40.2	52 49.0	•• 45.1	102 47.9	•• 28.3	340 22.3	•• 26.1	55 32.8	126	•19 12.6	−100
16	196 51.8	101 14.4	40.2	67 49.9	44.7	117 49.9	28.4	355 24.6	26.2	70 04.4	127	19 02.6	−101
17	211 54.2	116 13.8	40.2	82 50.7	44.4	132 51.9	28.4	10 26.9	26.3	84 36.1	128	18 52.5	−102
18	226 56.7	131 13.2	+21 40.3	97 51.5	+19 44.0	147 53.9	+22 28.4	25 29.2	− 6 26.4	99 07.9	128	+18 42.3	−102
19	241 59.2	146 12.6	40.3	112 52.3	43.6	162 55.9	28.5	40 31.5	26.4	113 39.7	129	18 32.1	−104
20	257 01.6	161 12.0	40.3	127 53.1	43.2	177 57.9	28.5	55 33.8	26.5	128 11.6	130	18 21.7	−104
21	272 04.1	176 11.4	•• 40.3	142 53.9	•• 42.8	192 59.9	•• 28.5	70 36.1	•• 26.6	142 43.6	131	•18 11.3	−105
22	287 06.6	191 10.8	40.4	157 54.7	42.4	208 01.9	28.6	85 38.4	26.7	157 15.7	132	18 00.8	−105
23	302 09.0	206 10.2	40.4	172 55.5	42.0	223 03.9	28.6	100 40.7	26.7	171 47.9	132	17 50.3	−106
9 0	317 11.5	221 09.6	+21 40.4	187 56.3	+19 41.6	238 05.9	+22 28.6	115 43.0	− 6 26.8	186 20.1	134	+17 39.7	−107
1	332 14.0	236 09.0	40.4	202 57.1	41.2	253 07.8	28.7	130 45.3	26.9	200 52.5	134	17 29.0	−108
2	347 16.4	251 08.4	40.5	217 57.9	40.8	268 09.8	28.7	145 47.6	27.0	215 24.9	134	17 18.2	−108
3	2 18.9	266 07.8	•• 40.5	232 58.7	•• 40.4	283 11.8	•• 28.7	160 49.9	•• 27.0	229 57.3	136	•17 07.4	−109
4	17 21.3	281 07.2	40.5	247 59.6	40.0	298 13.8	28.8	175 52.3	27.1	244 29.9	136	16 56.5	−110
5	32 23.8	296 06.6	40.5	263 00.4	39.6	313 15.8	28.8	190 54.6	27.2	259 02.5	137	16 45.5	−110
6	47 26.3	311 06.0	+21 40.5	278 01.2	+19 39.2	328 17.8	+22 28.8	205 56.9	− 6 27.3	273 35.2	138	+16 34.5	−111
7	62 28.7	326 05.4	40.5	293 02.0	38.8	343 19.8	28.9	220 59.2	27.3	288 08.0	138	16 23.4	−112
8	77 31.2	341 04.8	40.5	308 02.8	38.4	358 21.8	28.9	236 01.5	27.4	302 40.8	139	16 12.2	−112
9	92 33.7	356 04.2	•• 40.6	323 03.6	•• 38.0	13 23.8	•• 28.9	251 03.8	•• 27.5	317 13.7	140	•16 01.0	−113
10	107 36.1	11 03.6	40.6	338 04.4	37.6	28 25.8	29.0	266 06.1	27.5	331 46.7	140	15 49.7	−113
11	122 38.6	26 03.0	40.6	353 05.2	37.2	43 27.8	29.0	281 08.4	27.6	346 19.7	142	15 38.4	−114
12	137 41.1	41 02.4	+21 40.6	8 06.0	+19 36.8	58 29.8	+22 29.0	296 10.7	− 6 27.7	0 52.9	141	+15 27.0	−115
13	152 43.5	56 01.8	40.6	23 06.8	36.4	73 31.8	29.1	311 13.0	27.8	15 26.0	143	15 15.5	−115
14	167 46.0	71 01.2	40.6	38 07.7	36.0	88 33.8	29.1	326 15.3	27.8	29 59.3	143	15 04.0	−116
15	182 48.5	86 00.6	•• 40.6	53 08.5	•• 35.6	103 35.8	•• 29.1	341 17.6	•• 27.9	44 32.6	144	•14 52.4	−116
16	197 50.9	101 00.0	40.6	68 09.3	35.2	118 37.8	29.2	356 19.9	28.0	59 06.0	145	14 40.8	−117
17	212 53.4	115 59.4	40.6	83 10.1	34.8	133 39.8	29.2	11 22.2	28.1	73 39.5	145	14 29.1	−117
18	227 55.8	130 58.8	+21 40.6	98 10.9	+19 34.4	148 41.8	+22 29.2	26 24.5	− 6 28.1	88 13.0	146	+14 17.4	−118
19	242 58.3	145 58.2	40.6	113 11.7	34.0	163 43.7	29.2	41 26.8	28.2	102 46.6	147	14 05.6	−118
20	258 00.8	160 57.6	40.6	128 12.5	33.6	178 45.7	29.3	56 29.1	28.3	117 20.3	147	13 53.8	−119
21	273 03.2	175 57.0	•• 40.6	143 13.3	•• 33.2	193 47.7	•• 29.3	71 31.4	•• 28.4	131 54.0	148	•13 41.9	−120
22	288 05.7	190 56.4	40.6	158 14.2	32.8	208 49.7	29.3	86 33.7	28.4	146 27.8	148	13 29.9	−120
23	303 08.2	205 55.8	40.6	173 15.0	32.4	223 51.7	29.4	101 36.0	28.5	161 01.6	149	13 17.9	−120
10 0	318 10.6	220 55.2	+21 40.6	188 15.8	+19 32.0	238 53.7	+22 29.4	116 38.3	− 6 28.6	175 35.5	150	+13 05.9	−121
1	333 13.1	235 54.5	40.6	203 16.6	31.6	253 55.7	29.4	131 40.6	28.7	190 09.5	150	12 53.8	−121
2	348 15.6	250 53.9	40.6	218 17.4	31.2	268 57.7	29.5	146 42.9	28.7	204 43.5	151	12 41.7	−122
3	3 18.0	265 53.3	•• 40.6	233 18.2	•• 30.8	283 59.7	•• 29.5	161 45.2	•• 28.8	219 17.6	151	•12 29.5	−122
4	18 20.5	280 52.7	40.6	248 19.0	30.4	299 01.7	29.5	176 47.5	28.9	233 51.7	152	12 17.3	−122
5	33 22.9	295 52.1	40.6	263 19.8	30.0	314 03.7	29.6	191 49.8	29.0	248 25.9	153	12 05.1	−123
6	48 25.4	310 51.5	+21 40.6	278 20.7	+19 29.6	329 05.7	+22 29.6	206 52.1	− 6 29.0	263 00.2	153	+11 52.8	−124
7	63 27.9	325 50.9	40.6	293 21.5	29.2	344 07.7	29.6	221 54.4	29.1	277 34.5	154	11 40.4	−123
8	78 30.3	340 50.3	40.6	308 22.3	28.8	359 09.7	29.7	236 56.7	29.2	292 08.9	154	11 28.1	−124
9	93 32.8	355 49.7	•• 40.5	323 23.1	•• 28.4	14 11.7	•• 29.7	251 59.0	•• 29.3	306 43.3	155	•11 15.7	−125
10	108 35.3	10 49.1	40.5	338 23.9	28.0	29 13.7	29.7	267 01.3	29.3	321 17.8	155	11 03.2	−125
11	123 37.7	25 48.5	40.5	353 24.7	27.6	44 15.7	29.8	282 03.6	29.4	335 52.3	156	10 50.7	−125
12	138 40.2	40 47.9	+21 40.5	8 25.5	+19 27.2	59 17.7	+22 29.8	297 05.9	− 6 29.5	350 26.9	156	+10 38.2	−126
13	153 42.7	55 47.3	40.5	23 26.4	26.8	74 19.7	29.8	312 08.1	29.6	5 01.5	157	10 25.6	−126
14	168 45.1	70 46.7	40.5	38 27.2	26.4	89 21.7	29.9	327 10.4	29.6	19 36.2	157	10 13.0	−126
15	183 47.6	85 46.1	•• 40.5	53 28.0	•• 26.0	104 23.7	•• 29.9	342 12.7	•• 29.7	34 10.9	158	•10 00.4	−127
16	198 50.1	100 45.5	40.4	68 28.8	25.6	119 25.7	29.9	357 15.0	29.8	48 45.7	158	9 47.7	−126
17	213 52.5	115 44.8	40.4	83 29.6	25.2	134 27.7	30.0	12 17.3	29.9	63 20.5	159	9 35.1	−128
18	228 55.0	130 44.2	+21 40.4	98 30.4	+19 24.8	149 29.7	+22 30.0	27 19.6	− 6 30.0	77 55.4	159	+ 9 22.3	−127
19	243 57.4	145 43.6	40.4	113 31.3	24.4	164 31.7	30.0	42 21.9	30.0	92 30.3	160	9 09.6	−128
20	258 59.9	160 43.0	40.4	128 32.1	24.0	179 33.7	30.1	57 24.2	30.1	107 05.3	160	8 56.8	−128
21	274 02.4	175 42.4	•• 40.3	143 32.9	•• 23.5	194 35.7	•• 30.1	72 26.5	•• 30.2	121 40.3	160	• 8 44.0	−129
22	289 04.8	190 41.8	40.3	158 33.7	23.1	209 37.7	30.1	87 28.8	30.3	136 15.3	161	8 31.1	−128
23	304 07.3	205 41.2	40.3	173 34.5	22.7	224 39.7	30.2	102 31.1	30.3	150 50.4	161	8 18.3	−129
24	319 09.8	220 40.6	+21 40.3	188 35.3	+19 22.3	239 41.7	+22 30.2	117 33.4	− 6 30.4	165 25.5	162	+ 8 05.4	−129
code	−	− 6	0	+ 8	− 4	+ 20	+ 1	+ 23	− 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
8	0	178 35.5	+16 17.8
	1	193 35.6	17.1
	2	208 35.7	16.4
	3	223 35.7	15.7
	4	238 35.8	15.0
	5	253 35.9	14.3
	6	268 36.0	+16 13.6
	7	283 36.0	12.9
	8	298 36.1	12.2
	9	313 36.2	11.5
	10	328 36.3	10.8
	11	343 36.4	10.0
	12	358 36.4	+16 09.3
	13	13 36.5	08.6
	14	28 36.6	07.9
	15	43 36.7	07.2
	16	58 36.8	06.5
	17	73 36.8	05.8
	18	88 36.9	+16 05.1
	19	103 37.0	04.4
	20	118 37.1	03.6
	21	133 37.2	02.9
	22	148 37.2	02.2
	23	163 37.3	01.5
9	0	178 37.4	+16 00.8
	1	193 37.5	16 00.1
	2	208 37.6	15 59.3
	3	223 37.7	58.6
	4	238 37.7	57.9
	5	253 37.8	57.2
	6	268 37.9	+15 56.5
	7	283 38.0	55.8
	8	298 38.1	55.0
	9	313 38.2	54.3
	10	328 38.3	53.6
	11	343 38.3	52.9
	12	358 38.4	+15 52.2
	13	13 38.5	51.4
	14	28 38.6	50.7
	15	43 38.7	50.0
	16	58 38.8	49.3
	17	73 38.9	48.6
	18	88 38.9	+15 47.8
	19	103 39.0	47.1
	20	118 39.1	46.4
	21	133 39.2	45.7
	22	148 39.3	44.9
	23	163 39.4	44.2
10	0	178 39.5	+15 43.5
	1	193 39.6	42.8
	2	208 39.7	42.0
	3	223 39.7	41.3
	4	238 39.8	40.6
	5	253 39.9	39.8
	6	268 40.0	+15 39.1
	7	283 40.1	38.4
	8	298 40.2	37.7
	9	313 40.3	36.9
	10	328 40.4	36.2
	11	343 40.5	35.5
	12	358 40.6	+15 34.7
	13	13 40.7	34.0
	14	28 40.7	33.3
	15	43 40.8	32.5
	16	58 40.9	31.8
	17	73 41.0	31.1
	18	88 41.1	+15 30.3
	19	103 41.2	29.6
	20	118 41.3	28.9
	21	133 41.4	28.1
	22	148 41.5	27.4
	23	163 41.6	26.7
	24	178 41.7	+15 25.9
code		—	- 8

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.3	−40 29.0
5	Achernar	335 59.7	−57 27.9
30	Acrux	174 00.3	−62 50.8
19	Adhara	255 48.1	−28 54.2
10	Aldebaran	291 41.1	+16 25.2
32	Alioth	167 00.1	+56 12.9
34	Alkaid	153 34.2	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.1	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.8	+28 50.1
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.5	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.2	−68 57.1
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.3	+ 6 18.7
16	Betelg'se	271 50.1	+ 7 24.2
17	Canopus	264 16.5	−52 39.9
12	Capella	281 41.1	+45 57.2
53	Deneb	50 01.7	+45 06.9
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.6	−18 14.2
27	Dubhe	194 47.0	+62 00.2
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 06.6	+51 29.8
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.6	−56 51.5
29	Gienah	176 38.8	−17 17.2
35	Hadar	149 52.0	−60 09.4
6	Hamal	328 51.4	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.6	+74 20.9
57	Markab	14 22.8	+14 57.5
8	Menkar	315 02.0	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.6
9	Mirfak	309 44.8	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.1
21	Pollux	244 22.9	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.8
11	Rigel	281 55.4	− 8 15.0
38	Rigil Kent.	140 53.4	−60 39.1
44	Sabik	103 03.8	−15 40.2
3	Schedar	350 31.6	+56 16.9
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.5	−16 38.8
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT h	Equation of Time (App.—Mean) 8 m s	9 m s	10 m s
0	− 5 38.2	− 5 30.5	− 5 22.3
6	− 5 36.3	− 5 28.5	− 5 20.1
12	− 5 34.4	− 5 26.5	− 5 17.9
18	− 5 32.5	− 5 24.4	− 5 15.7
24	− 5 30.5	− 5 22.3	− 5 13.5

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 8 h m	9 h m	10 h m	11 h m
72	1 32	////	▭	0 34	3 36	5 42
70	2 21	////	▭	1 43	3 59	5 52
68	2 52	////	26 20	2 20	4 16	6 01
66	3 15	////	0 45	2 45	4 30	6 08
64	3 32	////	1 20	3 05	4 42	6 13
62	3 47	////	1 45	3 21	4 52	6 18
60	3 59	////	2 05	3 34	5 00	6 23
58	4 09	////	2 21	3 45	5 07	6 26
56	4 19	0 13	2 35	3 55	5 14	6 30
54	4 27	1 23	2 47	4 04	5 19	6 33
52	4 34	1 53	2 57	4 12	5 25	6 35
50	4 40	2 15	3 06	4 18	5 29	6 38
45	4 54	2 53	3 26	4 33	5 39	6 43
40	5 05	3 20	3 42	4 45	5 47	6 48
35	5 15	3 39	3 55	4 55	5 54	6 51
30	5 24	3 55	4 06	5 04	6 01	6 55
20	5 38	4 20	4 26	5 20	6 11	7 01
10	5 50	4 36	4 43	5 33	6 21	7 06
0	6 02	4 50	4 59	5 46	6 29	7 11
10	6 13	5 02	5 15	5 58	6 38	7 15
20	6 25	5 11	5 32	6 11	6 47	7 20
30	6 39	5 18	5 51	6 26	6 58	7 26
35	6 47	5 22	6 02	6 35	7 04	7 29
40	6 56	5 25	6 15	6 45	7 10	7 33
45	7 06	5 28	6 31	6 56	7 18	7 37
50	7 19	5 30	6 49	7 10	7 28	7 42
52	7 25	5 31	6 58	7 17	7 32	7 45
54	7 31	5 31	7 07	7 24	7 37	7 47
56	7 38	5 32	7 18	7 32	7 42	7 50
58	7 46	5 33	7 31	7 41	7 48	7 53
60	7 55	5 33	7 45	7 51	7 55	7 57

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 8 h m	9 h m	10 h m	11 h m
72	22 30	////	22 54	21 24	20 45	20 16
70	21 45	////	21 42	20 59	20 32	20 11
68	21 15	////	21 05	20 40	20 22	20 07
66	20 54	////	20 38	20 24	20 13	20 04
64	20 36	////	20 17	20 11	20 06	20 01
62	20 22	////	20 01	20 01	20 00	19 58
60	20 10	////	19 47	19 51	19 54	19 56
58	20 00	////	19 34	19 43	19 49	19 54
56	19 51	23 34	19 24	19 36	19 45	19 52
54	19 43	22 41	19 15	19 29	19 41	19 51
52	19 36	22 13	19 06	19 23	19 37	19 49
50	19 30	21 52	18 59	19 18	19 34	19 48
45	19 16	21 15	18 43	19 07	19 27	19 45
40	19 05	20 49	18 30	18 57	19 21	19 43
35	18 55	20 30	18 18	18 49	19 16	19 41
30	18 47	20 14	18 08	18 41	19 11	19 39
20	18 33	19 51	17 51	18 29	19 03	19 35
10	18 20	19 33	17 36	18 17	18 56	19 33
0	18 09	19 20	17 22	18 07	18 49	19 30
10	17 58	19 10	17 08	17 56	18 43	19 27
20	17 46	19 01	16 52	17 45	18 35	19 24
30	17 32	18 53	16 35	17 32	18 27	19 21
35	17 24	18 50	16 24	17 24	18 22	19 19
40	17 15	18 47	16 12	17 15	18 17	19 16
45	17 05	18 45	15 58	17 05	18 10	19 14
50	16 53	18 44	15 41	16 53	18 02	19 10
52	16 47	18 43	15 33	16 47	17 59	19 09
54	16 40	18 42	15 24	16 40	17 55	19 07
56	16 33	18 41	15 13	16 33	17 50	19 05
58	16 25	18 41	15 01	16 25	17 46	19 04
60	16 16	18 41	14 48	16 16	17 40	19 01

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
8	11 11	9 15	11 29	8 10	16 18
9	11 56	9 16	11 28	8 07	16 15
10	12 39	9 17	11 26	8 03	16 11
11	13 20	9 18	11 25	8 00	16 07

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	8 ′	9 ′	10 ′
0	13.1	12.8	12.2
4	13.1	12.8	12.3
8	13.2	12.8	12.3
12	13.2	12.8	12.3
16	13.2	12.9	12.4
20	13.3	12.9	12.4
24	13.3	13.0	12.5
28	13.4	13.0	12.6
32	13.5	13.1	12.7
36	13.5	13.2	12.8
40	13.6	13.3	12.9
44	13.7	13.4	13.0
48	13.8	13.5	13.2
52	13.9	13.7	13.3
56	14.0	13.8	13.5
60	14.1	13.9	13.6
64	14.3	14.1	13.8
68	14.4	14.2	14.0
72	14.5	14.3	14.1
76	14.6	14.5	14.3
80	14.8	14.6	14.5
84	14.9	14.8	14.7
88	15.0	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	8 ′	9 ′	10 ′
0	16.9	17.2	17.4
4	16.9	17.1	17.4
8	16.9	17.1	17.4
12	16.9	17.1	17.4
16	16.8	17.0	17.3
20	16.8	17.0	17.3
24	16.7	16.9	17.2
28	16.7	16.9	17.1
32	16.6	16.8	17.0
36	16.5	16.7	16.9
40	16.4	16.6	16.8
44	16.4	16.5	16.6
48	16.3	16.4	16.5
52	16.2	16.2	16.4
56	16.0	16.1	16.2
60	15.9	16.0	16.1
64	15.8	15.8	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.3	15.2
84	15.2	15.1	15.0
88	15.1	15.0	14.9
90			

Subtract from table, back cover

New Moon 9

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
11 0	319 09.8	220 40.6	+21 40.3	188 35.3	+19 22.3	239 41.7	+22 30.2	117 33.4	− 6 30.4	165 25.5	162	+ 8 05.4	−129
1	334 12.2	235 40.0	40.2	203 36.2	21.9	254 43.7	30.2	132 35.7	30.5	180 00.7	162	7 52.5	−130
2	349 14.7	250 39.4	40.2	218 37.0	21.5	269 45.7	30.2	147 38.0	30.6	194 35.9	163	7 39.5	−129
3	4 17.2	265 38.7	•• 40.2	233 37.8	•• 21.1	284 47.7	•• 30.3	162 40.3	•• 30.6	209 11.2	163	• 7 26.6	−130
4	19 19.6	280 38.1	40.1	248 38.6	20.7	299 49.7	30.3	177 42.6	30.7	223 46.5	163	7 13.6	−130
5	34 22.1	295 37.5	40.1	263 39.4	20.3	314 51.7	30.3	192 44.9	30.8	238 21.8	164	7 00.6	−130
6	49 24.5	310 36.9	+21 40.1	278 40.2	+19 19.9	329 53.7	+22 30.4	207 47.2	− 6 30.9	252 57.2	164	+ 6 47.6	−131
7	64 27.0	325 36.3	40.0	293 41.1	19.5	344 55.7	30.4	222 49.5	30.9	267 32.6	164	6 34.5	−130
8	79 29.5	340 35.7	40.0	308 41.9	19.1	359 57.7	30.4	237 51.8	31.0	282 08.0	164	6 21.5	−131
9	94 31.9	355 35.1	•• 40.0	323 42.7	•• 18.7	14 59.7	•• 30.5	252 54.1	•• 31.1	296 43.4	165	• 6 08.4	−131
10	109 34.4	10 34.5	39.9	338 43.5	18.2	30 01.7	30.5	267 56.4	31.2	311 18.9	166	5 55.3	−131
11	124 36.9	25 33.9	39.9	353 44.3	17.8	45 03.7	30.5	282 58.7	31.2	325 54.5	165	5 42.2	−132
12	139 39.3	40 33.2	+21 39.9	8 45.2	+19 17.4	60 05.7	+22 30.6	298 01.0	− 6 31.3	340 30.0	166	+ 5 29.0	−131
13	154 41.8	55 32.6	39.8	23 46.0	17.0	75 07.8	30.6	313 03.3	31.4	355 05.6	166	5 15.9	−132
14	169 44.3	70 32.0	39.8	38 46.8	16.6	90 09.8	30.6	328 05.6	31.5	9 41.2	167	5 02.7	−132
15	184 46.7	85 31.4	•• 39.7	53 47.6	•• 16.2	105 11.8	•• 30.7	343 07.9	•• 31.5	24 16.9	166	• 4 49.5	−132
16	199 49.2	100 30.8	39.7	68 48.4	15.8	120 13.8	30.7	358 10.1	31.6	38 52.5	167	4 36.3	−132
17	214 51.7	115 30.2	39.7	83 49.3	15.4	135 15.8	30.7	13 12.4	31.7	53 28.2	167	4 23.1	−132
18	229 54.1	130 29.6	+21 39.6	98 50.1	+19 15.0	150 17.8	+22 30.7	28 14.7	− 6 31.8	68 03.9	168	+ 4 09.9	−132
19	244 56.6	145 29.0	39.6	113 50.9	14.6	165 19.8	30.8	43 17.0	31.9	82 39.7	167	3 56.7	−132
20	259 59.0	160 28.3	39.5	128 51.7	14.1	180 21.8	30.8	58 19.3	31.9	97 15.4	168	3 43.5	−133
21	275 01.5	175 27.7	•• 39.5	143 52.5	•• 13.7	195 23.8	•• 30.8	73 21.6	•• 32.0	111 51.2	168	• 3 30.2	−132
22	290 04.0	190 27.1	39.4	158 53.4	13.3	210 25.8	30.9	88 23.9	32.1	126 27.0	169	3 17.0	−133
23	305 06.4	205 26.5	39.4	173 54.2	12.9	225 27.8	30.9	103 26.2	32.2	141 02.9	168	3 03.7	−133
12 0	320 08.9	220 25.9	+21 39.3	188 55.0	+19 12.5	240 29.8	+22 30.9	118 28.5	− 6 32.2	155 38.7	169	+ 2 50.4	−132
1	335 11.4	235 25.3	39.3	203 55.8	12.1	255 31.8	31.0	133 30.8	32.3	170 14.6	168	2 37.2	−133
2	350 13.8	250 24.6	39.2	218 56.6	11.7	270 33.8	31.0	148 33.1	32.4	184 50.4	169	2 23.9	−133
3	5 16.3	265 24.0	•• 39.2	233 57.5	•• 11.3	285 35.8	•• 31.0	163 35.4	•• 32.5	199 26.3	169	• 2 10.6	−133
4	20 18.8	280 23.4	39.1	248 58.3	10.8	300 37.8	31.1	178 37.7	32.5	214 02.2	170	1 57.3	−133
5	35 21.2	295 22.8	39.1	263 59.1	10.4	315 39.8	31.1	193 40.0	32.6	228 38.2	169	1 44.0	−133
6	50 23.7	310 22.2	+21 39.0	278 59.9	+19 10.0	330 41.9	+22 31.1	208 42.3	− 6 32.7	243 14.1	170	+ 1 30.7	−133
7	65 26.2	325 21.6	39.0	294 00.8	09.6	345 43.9	31.1	223 44.6	32.8	257 50.1	169	1 17.4	−133
8	80 28.6	340 21.0	38.9	309 01.6	09.2	0 45.9	31.2	238 46.8	32.9	272 26.0	170	1 04.1	−133
9	95 31.1	355 20.3	•• 38.8	324 02.4	•• 08.8	15 47.9	•• 31.2	253 49.1	•• 32.9	287 02.0	170	• 0 50.8	−132
10	110 33.5	10 19.7	38.8	339 03.2	08.4	30 49.9	31.2	268 51.4	33.0	301 38.0	170	0 37.6	−133
11	125 36.0	25 19.1	38.7	354 04.0	07.9	45 51.9	31.3	283 53.7	33.1	316 14.0	170	0 24.3	−133
12	140 38.5	40 18.5	+21 38.7	9 04.9	+19 07.5	60 53.9	+22 31.3	298 56.0	− 6 33.2	330 50.0	170	+ 0 11.0	−133
13	155 40.9	55 17.9	38.6	24 05.7	07.1	75 55.9	31.3	313 58.3	33.2	345 26.0	170	− 0 02.3	−133
14	170 43.4	70 17.2	38.5	39 06.5	06.7	90 57.9	31.4	329 00.6	33.3	0 02.0	170	0 15.6	−133
15	185 45.9	85 16.6	•• 38.5	54 07.3	•• 06.3	105 59.9	•• 31.4	344 02.9	•• 33.4	14 38.0	170	• 0 28.9	−133
16	200 48.3	100 16.0	38.4	69 08.2	05.9	121 01.9	31.4	359 05.2	33.5	29 14.0	170	0 42.2	−133
17	215 50.8	115 15.4	38.3	84 09.0	05.5	136 03.9	31.4	14 07.5	33.6	43 50.0	170	0 55.5	−132
18	230 53.3	130 14.8	+21 38.3	99 09.8	+19 05.0	151 06.0	+22 31.5	29 09.8	− 6 33.6	58 26.0	171	− 1 08.7	−133
19	245 55.7	145 14.2	38.2	114 10.6	04.6	166 08.0	31.5	44 12.1	33.7	73 02.1	170	1 22.0	−132
20	260 58.2	160 13.5	38.1	129 11.5	04.2	181 10.0	31.5	59 14.3	33.8	87 38.1	170	1 35.2	−133
21	276 00.6	175 12.9	•• 38.1	144 12.3	•• 03.8	196 12.0	•• 31.6	74 16.6	•• 33.9	102 14.1	170	• 1 48.5	−132
22	291 03.1	190 12.3	38.0	159 13.1	03.4	211 14.0	31.6	89 18.9	33.9	116 50.1	170	2 01.7	−133
23	306 05.6	205 11.7	37.9	174 13.9	03.0	226 16.0	31.6	104 21.2	34.0	131 26.1	170	2 15.0	−132
13 0	321 08.0	220 11.1	+21 37.9	189 14.8	+19 02.5	241 18.0	+22 31.7	119 23.5	− 6 34.1	146 02.1	170	− 2 28.2	−132
1	336 10.5	235 10.4	37.8	204 15.6	02.1	256 20.0	31.7	134 25.8	34.2	160 38.1	170	2 41.4	−132
2	351 13.0	250 09.8	37.7	219 16.4	01.7	271 22.0	31.7	149 28.1	34.3	175 14.1	170	2 54.6	−132
3	6 15.4	265 09.2	•• 37.6	234 17.2	•• 01.3	286 24.1	•• 31.7	164 30.4	•• 34.3	189 50.1	170	• 3 07.8	−131
4	21 17.9	280 08.6	37.6	249 18.1	00.9	301 26.1	31.8	179 32.7	34.4	204 26.1	170	3 20.9	−132
5	36 20.4	295 08.0	37.5	264 18.9	00.4	316 28.1	31.8	194 35.0	34.5	219 02.1	170	3 34.1	−131
6	51 22.8	310 07.3	+21 37.4	279 19.7	+19 00.0	331 30.1	+22 31.8	209 37.3	− 6 34.6	233 38.1	169	− 3 47.2	−132
7	66 25.3	325 06.7	37.3	294 20.5	18 59.6	346 32.1	31.9	224 39.5	34.6	248 14.0	170	4 00.4	−131
8	81 27.8	340 06.1	37.2	309 21.4	59.2	1 34.1	31.9	239 41.8	34.7	262 50.0	169	4 13.5	−131
9	96 30.2	355 05.5	•• 37.2	324 22.2	•• 58.8	16 36.1	•• 31.9	254 44.1	•• 34.8	277 25.9	169	• 4 26.6	−131
10	111 32.7	10 04.9	37.1	339 23.0	58.3	31 38.1	32.0	269 46.4	34.9	292 01.8	169	4 39.7	−130
11	126 35.1	25 04.2	37.0	354 23.9	57.9	46 40.2	32.0	284 48.7	35.0	306 37.7	169	4 52.7	−131
12	141 37.6	40 03.6	+21 36.9	9 24.7	+18 57.5	61 42.2	+22 32.0	299 51.0	− 6 35.0	321 13.6	168	− 5 05.8	−130
13	156 40.1	55 03.0	36.8	24 25.5	57.1	76 44.2	32.0	314 53.3	35.1	335 49.4	169	5 18.8	−130
14	171 42.5	70 02.4	36.7	39 26.3	56.7	91 46.2	32.1	329 55.6	35.2	350 25.3	168	5 31.8	−130
15	186 45.0	85 01.8	•• 36.6	54 27.2	•• 56.2	106 48.2	•• 32.1	344 57.9	•• 35.3	5 01.1	168	• 5 44.8	−130
16	201 47.5	100 01.1	36.6	69 28.0	55.8	121 50.2	32.1	0 00.1	35.4	19 36.9	168	5 57.8	−129
17	216 49.9	115 00.5	36.5	84 28.8	55.4	136 52.2	32.2	15 02.4	35.4	34 12.7	168	6 10.7	−129
18	231 52.4	129 59.9	+21 36.4	99 29.6	+18 55.0	151 54.2	+22 32.2	30 04.7	− 6 35.5	48 48.5	167	− 6 23.6	−129
19	246 54.9	144 59.3	36.3	114 30.5	54.6	166 56.3	32.2	45 07.0	35.6	63 24.2	168	6 36.5	−129
20	261 57.3	159 58.6	36.2	129 31.3	54.1	181 58.3	32.3	60 09.3	35.7	78 00.0	167	6 49.4	−129
21	276 59.8	174 58.0	•• 36.1	144 32.1	•• 53.7	197 00.3	•• 32.3	75 11.6	•• 35.7	92 35.7	166	• 7 02.3	−128
22	292 02.2	189 57.4	36.0	159 33.0	53.3	212 02.3	32.3	90 13.9	35.8	107 11.3	167	7 15.1	−128
23	307 04.7	204 56.8	35.9	174 33.8	52.9	227 04.3	32.3	105 16.2	35.9	121 47.0	166	7 27.9	−128
24	322 07.2	219 56.2	+21 35.8	189 34.6	+18 52.4	242 06.3	+22 32.4	120 18.4	− 6 36.0	136 22.6	166	− 7 40.7	−127
code	−	− 6	− 1	+ 8	− 4	+ 20	0	+ 23	0				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
11	0	178 41.7	+15 25.9
	1	193 41.8	25.2
	2	208 41.9	24.5
	3	223 42.0	23.7
	4	238 42.1	23.0
	5	253 42.2	22.2
	6	268 42.3	+15 21.5
	7	283 42.4	20.8
	8	298 42.4	20.0
	9	313 42.5	19.3
	10	328 42.6	18.5
	11	343 42.7	17.8
	12	358 42.8	+15 17.1
	13	13 42.9	16.3
	14	28 43.0	15.6
	15	43 43.1	14.8
	16	58 43.2	14.1
	17	73 43.3	13.3
	18	88 43.4	+15 12.6
	19	103 43.5	11.9
	20	118 43.6	11.1
	21	133 43.7	10.4
	22	148 43.8	09.6
	23	163 43.9	08.9
12	0	178 44.0	+15 08.1
	1	193 44.1	07.4
	2	208 44.2	06.6
	3	223 44.3	05.9
	4	238 44.4	05.1
	5	253 44.5	04.4
	6	268 44.6	+15 03.6
	7	283 44.7	02.9
	8	298 44.8	02.1
	9	313 44.9	01.4
	10	328 45.1	15 00.6
	11	343 45.2	14 59.9
	12	358 45.3	+14 59.1
	13	13 45.4	58.4
	14	28 45.5	57.6
	15	43 45.6	56.9
	16	58 45.7	56.1
	17	73 45.8	55.4
	18	88 45.9	+14 54.6
	19	103 46.0	53.9
	20	118 46.1	53.1
	21	133 46.2	52.4
	22	148 46.3	51.6
	23	163 46.4	50.8
13	0	178 46.5	+14 50.1
	1	193 46.6	49.3
	2	208 46.7	48.6
	3	223 46.8	47.8
	4	238 47.0	47.1
	5	253 47.1	46.3
	6	268 47.2	+14 45.5
	7	283 47.3	44.8
	8	298 47.4	44.0
	9	313 47.5	43.3
	10	328 47.6	42.5
	11	343 47.7	41.7
	12	358 47.8	+14 41.0
	13	13 47.9	40.2
	14	28 48.0	39.5
	15	43 48.2	38.7
	16	58 48.3	37.9
	17	73 48.4	37.2
	18	88 48.5	+14 36.4
	19	103 48.6	35.6
	20	118 48.7	34.9
	21	133 48.8	34.1
	22	148 48.9	33.3
	23	163 49.0	32.6
	24	178 49.2	+14 31.8
code		—	− 7

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.2	−40 29.0
5	Achernar	335 59.6	−57 27.9
30	Acrux	174 00.3	−62 50.8
19	Adhara	255 48.1	−28 54.2
10	Aldebaran	291 41.0	+16 25.2
32	Alioth	167 00.1	+56 12.8
34	Alkaid	153 34.2	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.1	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.8	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.5	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.2	−68 57.1
22	Avior	234 37.2	−59 21.5
13	Bellatrix	279 20.3	+ 6 18.7
16	Betelg'se	271 50.1	+ 7 24.2
17	Canopus	264 16.5	−52 39.9
12	Capella	281 41.0	+45 57.2
53	Deneb	50 01.7	+45 06.9
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.6	−18 14.2
27	Dubhe	194 47.0	+62 00.2
14	Elnath	279 09.6	+28 34.3
47	Eltanin	91 06.6	+51 29.8
54	Enif	34 30.9	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.6	−56 51.5
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.0	−60 09.4
6	Hamal	328 51.4	+23 14.7
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.6	+74 20.9
57	Markab	14 22.8	+14 57.5
8	Menkar	315 02.0	+ 3 54.7
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.5
9	Mirfak	309 44.8	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 47.0	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.0
38	Rigil Kent.	140 53.4	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.6	+56 17.0
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.5	−16 38.8
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 11 m s	12 m s	13 m s
h			
0	− 5 13.5	− 5 04.1	− 4 54.1
6	− 5 11.2	− 5 01.7	− 4 51.6
12	− 5 08.8	− 4 59.2	− 4 48.9
18	− 5 06.5	− 4 56.7	− 4 46.3
24	− 5 04.1	− 4 54.1	− 4 43.6

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 11 h m	12 h m	13 h m	14 h m
72	2 00	////	5 42	7 37	9 29	11 28
70	2 39	////	5 52	7 38	9 22	11 10
68	3 05	////	6 01	7 39	9 17	10 57
66	3 25	////	6 08	7 40	9 12	10 46
64	3 42	////	6 13	7 41	9 08	10 37
62	3 55	////	6 18	7 42	9 05	10 29
60	4 06	////	6 23	7 43	9 02	10 22
58	4 16	////	6 26	7 43	9 00	10 16
56	4 24	0 57	6 30	7 44	8 57	10 11
54	4 32	1 38	6 33	7 44	8 55	10 07
52	4 39	2 04	6 35	7 45	8 53	10 03
50	4 45	2 24	6 38	7 45	8 52	9 59
45	4 58	2 59	6 43	7 46	8 48	9 51
40	5 08	3 23	6 48	7 47	8 45	9 44
35	5 17	3 43	6 51	7 47	8 43	9 38
30	5 25	3 58	6 55	7 48	8 40	9 33
20	5 39	4 21	7 01	7 49	8 36	9 25
10	5 51	4 38	7 06	7 50	8 33	9 17
0	6 02	4 51	7 11	7 50	8 30	9 10
10	6 12	5 01	7 15	7 51	8 27	9 03
20	6 24	5 09	7 20	7 52	8 23	8 55
30	6 37	5 17	7 26	7 53	8 20	8 47
35	6 44	5 19	7 29	7 54	8 18	8 42
40	6 52	5 22	7 33	7 54	8 15	8 37
45	7 02	5 24	7 37	7 55	8 12	8 31
50	7 14	5 26	7 42	7 56	8 09	8 23
52	7 19	5 26	7 45	7 56	8 08	8 20
54	7 25	5 27	7 47	7 57	8 06	8 16
56	7 32	5 26	7 50	7 57	8 04	8 12
58	7 40	5 27	7 53	7 58	8 02	8 07
60	7 48	5 27	7 57	7 59	8 00	8 02

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 11 h m	12 h m	13 h m	14 h m
72	22 04	////	20 16	19 49	19 21	18 47
70	21 27	////	20 11	19 51	19 31	19 07
68	21 01	////	20 07	19 53	19 38	19 22
66	20 42	////	20 04	19 54	19 45	19 34
64	20 26	////	20 01	19 56	19 50	19 45
62	20 13	////	19 58	19 57	19 55	19 54
60	20 02	////	19 56	19 58	19 59	20 02
58	19 53	////	19 54	19 59	20 03	20 08
56	19 44	23 03	19 52	19 59	20 06	20 15
54	19 37	22 26	19 51	20 00	20 09	20 20
52	19 30	22 01	19 49	20 01	20 12	20 25
50	19 24	21 42	19 48	20 01	20 15	20 29
45	19 12	21 09	19 45	20 03	20 20	20 39
40	19 01	20 44	19 43	20 04	20 25	20 47
35	18 52	20 26	19 41	20 05	20 29	20 54
30	18 44	20 11	19 39	20 05	20 32	21 00
20	18 31	19 49	19 35	20 07	20 38	21 11
10	18 19	19 32	19 33	20 08	20 44	21 21
0	18 08	19 19	19 30	20 09	20 49	21 30
10	17 58	19 10	19 27	20 11	20 54	21 39
20	17 47	19 02	19 24	20 12	21 00	21 48
30	17 34	18 55	19 21	20 13	21 06	21 59
35	17 26	18 52	19 19	20 14	21 09	22 06
40	17 18	18 50	19 16	20 15	21 14	22 13
45	17 08	18 48	19 14	20 16	21 18	22 21
50	16 57	18 47	19 10	20 17	21 24	22 32
52	16 51	18 46	19 09	20 18	21 27	22 36
54	16 45	18 46	19 07	20 18	21 30	22 42
56	16 39	18 46	19 05	20 19	21 33	22 47
58	16 31	18 46	19 04	20 20	21 36	22 54
60	16 23	18 47	19 01	20 21	21 40	23 01

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
11	13 20	9 18	11 25	8 00	16 07
12	14 00	9 19	11 24	7 57	16 04
13	14 39	9 20	11 22	7 54	16 00
14	15 20	9 21	11 21	7 51	15 56

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	11 ′	12 ′	13 ′
0	12.0	11.9	11.7
4	12.0	11.9	11.7
8	12.0	11.9	11.8
12	12.1	11.9	11.8
16	12.1	12.0	11.9
20	12.2	12.1	12.0
24	12.3	12.2	12.0
28	12.4	12.2	12.1
32	12.5	12.4	12.2
36	12.6	12.5	12.4
40	12.7	12.6	12.5
44	12.8	12.7	12.6
48	13.0	12.9	12.8
52	13.1	13.1	13.0
56	13.3	13.2	13.1
60	13.5	13.4	13.3
64	13.6	13.6	13.5
68	13.8	13.8	13.7
72	14.0	14.0	13.9
76	14.2	14.2	14.1
80	14.4	14.4	14.3
84	14.6	14.6	14.5
88	14.7	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	11 ′	12 ′	13 ′
0	17.6	17.7	17.7
4	17.6	17.6	17.7
8	17.5	17.6	17.7
12	17.5	17.6	17.6
16	17.5	17.5	17.6
20	17.4	17.5	17.5
24	17.3	17.4	17.4
28	17.2	17.3	17.3
32	17.1	17.2	17.2
36	17.0	17.0	17.1
40	16.9	16.9	17.0
44	16.7	16.8	16.8
48	16.6	16.6	16.7
52	16.4	16.5	16.5
56	16.3	16.3	16.3
60	16.1	16.1	16.1
64	15.9	15.9	16.0
68	15.7	15.8	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	14.9
88	14.8	14.8	14.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.7 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
14 h 0	322 07.2	219 56.2	+21 35.8	189 34.6	+18 52.4	242 06.3	+22 32.4	120 18.4	− 6 36.0	136 22.6	166	− 7 40.7	−127
1	337 09.6	234 55.5	35.7	204 35.5	52.0	257 08.4	32.4	135 20.7	36.1	150 58.2	165	7 53.4	−127
2	352 12.1	249 54.9	35.6	219 36.3	51.6	272 10.4	32.4	150 23.0	36.1	165 33.7	166	8 06.1	−127
3	7 14.6	264 54.3	•• 35.5	234 37.1	•• 51.2	287 12.4	•• 32.5	165 25.3	•• 36.2	180 09.3	165	• 8 18.8	−127
4	22 17.0	279 53.7	35.4	249 37.9	50.8	302 14.4	32.5	180 27.6	36.3	194 44.8	164	8 31.5	−126
5	37 19.5	294 53.0	35.3	264 38.8	50.3	317 16.4	32.5	195 29.9	36.4	209 20.2	165	8 44.1	−126
6	52 22.0	309 52.4	+21 35.2	279 39.6	+18 49.9	332 18.4	+22 32.5	210 32.2	− 6 36.5	223 55.7	164	− 8 56.7	−126
7	67 24.4	324 51.8	35.1	294 40.4	49.5	347 20.5	32.6	225 34.5	36.5	238 31.1	163	9 09.3	−125
8	82 26.9	339 51.2	35.0	309 41.3	49.1	2 22.5	32.6	240 36.7	36.6	253 06.4	164	9 21.8	−125
9	97 29.4	354 50.5	•• 34.9	324 42.1	•• 48.6	17 24.5	•• 32.6	255 39.0	•• 36.7	267 41.8	162	• 9 34.3	−125
10	112 31.8	9 49.9	34.8	339 42.9	48.2	32 26.5	32.7	270 41.3	36.8	282 17.0	163	9 46.8	−124
11	127 34.3	24 49.3	34.7	354 43.8	47.8	47 28.5	32.7	285 43.6	36.9	296 52.3	162	9 59.2	−124
12	142 36.7	39 48.7	+21 34.6	9 44.6	+18 47.4	62 30.5	+22 32.7	300 45.9	− 6 36.9	311 27.5	162	−10 11.6	−124
13	157 39.2	54 48.0	34.5	24 45.4	46.9	77 32.6	32.7	315 48.2	37.0	326 02.7	161	10 24.0	−123
14	172 41.7	69 47.4	34.3	39 46.3	46.5	92 34.6	32.8	330 50.5	37.1	340 37.8	161	10 36.3	−123
15	187 44.1	84 46.8	•• 34.2	54 47.1	•• 46.1	107 36.6	•• 32.8	345 52.7	•• 37.2	355 12.9	160	•10 48.6	−123
16	202 46.6	99 46.2	34.1	69 47.9	45.7	122 38.6	32.8	0 55.0	37.3	9 47.9	160	11 00.9	−122
17	217 49.1	114 45.5	34.0	84 48.7	45.2	137 40.6	32.9	15 57.3	37.3	24 22.9	160	11 13.1	−122
18	232 51.5	129 44.9	+21 33.9	99 49.6	+18 44.8	152 42.7	+22 32.9	30 59.6	− 6 37.4	38 57.9	159	−11 25.3	−121
19	247 54.0	144 44.3	33.8	114 50.4	44.4	167 44.7	32.9	46 01.9	37.5	53 32.8	159	11 37.4	−121
20	262 56.5	159 43.7	33.7	129 51.2	43.9	182 46.7	32.9	61 04.2	37.6	68 07.7	158	11 49.5	−121
21	277 58.9	174 43.0	•• 33.5	144 52.1	•• 43.5	197 48.7	•• 33.0	76 06.5	•• 37.7	82 42.5	158	•12 01.6	−120
22	293 01.4	189 42.4	33.4	159 52.9	43.1	212 50.7	33.0	91 08.7	37.7	97 17.3	157	12 13.6	−119
23	308 03.9	204 41.8	33.3	174 53.7	42.7	227 52.8	33.0	106 11.0	37.8	111 52.0	157	12 25.5	−120
15 0	323 06.3	219 41.2	+21 33.2	189 54.6	+18 42.2	242 54.8	+22 33.1	121 13.3	− 6 37.9	126 26.7	156	−12 37.5	−118
1	338 08.8	234 40.5	33.1	204 55.4	41.8	257 56.8	33.1	136 15.6	38.0	141 01.3	155	12 49.3	−119
2	353 11.2	249 39.9	32.9	219 56.3	41.4	272 58.8	33.1	151 17.9	38.1	155 35.8	156	13 01.2	−118
3	8 13.7	264 39.3	•• 32.8	234 57.1	•• 40.9	288 00.8	•• 33.1	166 20.2	•• 38.1	170 10.4	154	•13 13.0	−117
4	23 16.2	279 38.6	32.7	249 57.9	40.5	303 02.9	33.2	181 22.5	38.2	184 44.8	154	13 24.7	−117
5	38 18.6	294 38.0	32.6	264 58.8	40.1	318 04.9	33.2	196 24.7	38.3	199 19.2	154	13 36.4	−117
6	53 21.1	309 37.4	+21 32.4	279 59.6	+18 39.7	333 06.9	+22 33.2	211 27.0	− 6 38.4	213 53.6	153	−13 48.1	−116
7	68 23.6	324 36.8	32.3	295 00.4	39.2	348 08.9	33.3	226 29.3	38.5	228 27.9	152	13 59.7	−115
8	83 26.0	339 36.1	32.2	310 01.3	38.8	3 10.9	33.3	241 31.6	38.5	243 02.1	152	14 11.2	−115
9	98 28.5	354 35.5	•• 32.1	325 02.1	•• 38.4	18 13.0	•• 33.3	256 33.9	•• 38.6	257 36.3	151	•14 22.7	−114
10	113 31.0	9 34.9	31.9	340 02.9	37.9	33 15.0	33.3	271 36.2	38.7	272 10.4	150	14 34.1	−114
11	128 33.4	24 34.3	31.8	355 03.8	37.5	48 17.0	33.4	286 38.4	38.8	286 44.4	150	14 45.5	−114
12	143 35.9	39 33.6	+21 31.7	10 04.6	+18 37.1	63 19.0	+22 33.4	301 40.7	− 6 38.9	301 18.4	150	−14 56.9	−112
13	158 38.3	54 33.0	31.5	25 05.4	36.7	78 21.1	33.4	316 43.0	38.9	315 52.4	148	15 08.1	−113
14	173 40.8	69 32.4	31.4	40 06.3	36.2	93 23.1	33.4	331 45.3	39.0	330 26.2	148	15 19.4	−111
15	188 43.3	84 31.7	•• 31.3	55 07.1	•• 35.8	108 25.1	•• 33.5	346 47.6	•• 39.1	345 00.0	148	•15 30.5	−112
16	203 45.7	99 31.1	31.1	70 07.9	35.4	123 27.1	33.5	1 49.9	39.2	359 33.8	147	15 41.7	−110
17	218 48.2	114 30.5	31.0	85 08.8	34.9	138 29.2	33.5	16 52.1	39.3	14 07.5	146	15 52.7	−110
18	233 50.7	129 29.9	+21 30.8	100 09.6	+18 34.5	153 31.2	+22 33.6	31 54.4	− 6 39.3	28 41.1	145	−16 03.7	−110
19	248 53.1	144 29.2	30.7	115 10.5	34.1	168 33.2	33.6	46 56.7	39.4	43 14.6	145	16 14.7	−108
20	263 55.6	159 28.6	30.6	130 11.3	33.6	183 35.2	33.6	61 59.0	39.5	57 48.1	144	16 25.5	−109
21	278 58.1	174 28.0	•• 30.4	145 12.1	•• 33.2	198 37.3	•• 33.6	77 01.3	•• 39.6	72 21.5	143	•16 36.4	−107
22	294 00.5	189 27.3	30.3	160 13.0	32.8	213 39.3	33.7	92 03.6	39.7	86 54.8	143	16 47.1	−107
23	309 03.0	204 26.7	30.1	175 13.8	32.3	228 41.3	33.7	107 05.8	39.7	101 28.1	142	16 57.8	−106
16 0	324 05.5	219 26.1	+21 30.0	190 14.6	+18 31.9	243 43.3	+22 33.7	122 08.1	− 6 39.8	116 01.3	141	−17 08.4	−106
1	339 07.9	234 25.4	29.8	205 15.5	31.5	258 45.4	33.7	137 10.4	39.9	130 34.4	141	17 19.0	−105
2	354 10.4	249 24.8	29.7	220 16.3	31.0	273 47.4	33.8	152 12.7	40.0	145 07.5	139	17 29.5	−104
3	9 12.8	264 24.2	•• 29.5	235 17.2	•• 30.6	288 49.4	•• 33.8	167 15.0	•• 40.1	159 40.4	139	•17 39.9	−104
4	24 15.3	279 23.6	29.4	250 18.0	30.2	303 51.4	33.8	182 17.2	40.1	174 13.3	139	17 50.3	−103
5	39 17.8	294 22.9	29.2	265 18.8	29.7	318 53.5	33.9	197 19.5	40.2	188 46.2	137	18 00.6	−102
6	54 20.2	309 22.3	+21 29.1	280 19.7	+18 29.3	333 55.5	+22 33.9	212 21.8	− 6 40.3	203 18.9	137	−18 10.8	−102
7	69 22.7	324 21.7	28.9	295 20.5	28.9	348 57.5	33.9	227 24.1	40.4	217 51.6	136	18 21.0	−101
8	84 25.2	339 21.0	28.8	310 21.3	28.4	3 59.5	33.9	242 26.4	40.5	232 24.2	135	18 31.1	−100
9	99 27.6	354 20.4	•• 28.6	325 22.2	•• 28.0	19 01.6	•• 34.0	257 28.6	•• 40.6	246 56.7	135	•18 41.1	−100
10	114 30.1	9 19.8	28.5	340 23.0	27.6	34 03.6	34.0	272 30.9	40.6	261 29.2	133	18 51.1	− 98
11	129 32.6	24 19.1	28.3	355 23.9	27.1	49 05.6	34.0	287 33.2	40.7	276 01.5	133	19 00.9	− 98
12	144 35.0	39 18.5	+21 28.2	10 24.7	+18 26.7	64 07.6	+22 34.0	302 35.5	− 6 40.8	290 33.8	132	−19 10.7	− 97
13	159 37.5	54 17.9	28.0	25 25.5	26.2	79 09.7	34.1	317 37.8	40.9	305 06.0	132	19 20.4	− 97
14	174 39.9	69 17.2	27.9	40 26.4	25.8	94 11.7	34.1	332 40.1	41.0	319 38.2	130	19 30.1	− 95
15	189 42.4	84 16.6	•• 27.7	55 27.2	•• 25.4	109 13.7	•• 34.1	347 42.3	•• 41.0	334 10.2	130	•19 39.6	− 95
16	204 44.9	99 16.0	27.5	70 28.1	24.9	124 15.8	34.2	2 44.6	41.1	348 42.2	128	19 49.1	− 94
17	219 47.3	114 15.4	27.4	85 28.9	24.5	139 17.8	34.2	17 46.9	41.2	3 14.0	128	19 58.5	− 94
18	234 49.8	129 14.7	+21 27.2	100 29.7	+18 24.1	154 19.8	+22 34.2	32 49.2	− 6 41.3	17 45.8	127	−20 07.9	− 92
19	249 52.3	144 14.1	27.0	115 30.6	23.6	169 21.9	34.2	47 51.5	41.4	32 17.5	127	20 17.1	− 92
20	264 54.7	159 13.5	26.9	130 31.4	23.2	184 23.9	34.3	62 53.7	41.5	46 49.2	125	20 26.3	− 90
21	279 57.2	174 12.8	•• 26.7	145 32.3	•• 22.8	199 25.9	•• 34.3	77 56.0	•• 41.5	61 20.7	125	•20 35.3	− 90
22	294 59.7	189 12.2	26.6	160 33.1	22.3	214 27.9	34.3	92 58.3	41.6	75 52.2	123	20 44.3	− 89
23	310 02.1	204 11.6	26.4	175 34.0	21.9	229 30.0	34.3	108 00.6	41.7	90 23.5	123	20 53.2	− 89
24	325 04.6	219 10.9	+21 26.2	190 34.8	+18 21.4	244 32.0	+22 34.4	123 02.9	− 6 41.8	104 54.8	122	−21 02.1	− 87
code	—	− 6	− 2	+ 8	− 4	+ 21	0	+ 23	0				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
14	0	178 49.2	+14 31.8
	1	193 49.3	31.0
	2	208 49.4	30.3
	3	223 49.5	29.5
	4	238 49.6	28.7
	5	253 49.7	28.0
	6	268 49.8	+14 27.2
	7	283 50.0	26.4
	8	298 50.1	25.7
	9	313 50.2	24.9
	10	328 50.3	24.1
	11	343 50.4	23.4
	12	358 50.5	+14 22.6
	13	13 50.6	21.8
	14	28 50.8	21.0
	15	43 50.9	20.3
	16	58 51.0	19.5
	17	73 51.1	18.7
	18	88 51.2	+14 18.0
	19	103 51.3	17.2
	20	118 51.5	16.4
	21	133 51.6	15.6
	22	148 51.7	14.9
	23	163 51.8	14.1
15	0	178 51.9	+14 13.3
	1	193 52.0	12.5
	2	208 52.2	11.8
	3	223 52.3	11.0
	4	238 52.4	10.2
	5	253 52.5	09.4
	6	268 52.6	+14 08.6
	7	283 52.8	07.9
	8	298 52.9	07.1
	9	313 53.0	06.3
	10	328 53.1	05.5
	11	343 53.2	04.8
	12	358 53.4	+14 04.0
	13	13 53.5	03.2
	14	28 53.6	02.4
	15	43 53.7	01.6
	16	58 53.9	00.8
	17	73 54.0	14 00.1
	18	88 54.1	+13 59.3
	19	103 54.2	58.5
	20	118 54.3	57.7
	21	133 54.5	56.9
	22	148 54.6	56.1
	23	163 54.7	55.4
16	0	178 54.8	+13 54.6
	1	193 55.0	53.8
	2	208 55.1	53.0
	3	223 55.2	52.2
	4	238 55.3	51.4
	5	253 55.5	50.6
	6	268 55.6	+13 49.9
	7	283 55.7	49.1
	8	298 55.8	48.3
	9	313 56.0	47.5
	10	328 56.1	46.7
	11	343 56.2	45.9
	12	358 56.3	+13 45.1
	13	13 56.5	44.3
	14	28 56.6	43.6
	15	43 56.7	42.8
	16	58 56.8	42.0
	17	73 57.0	41.2
	18	88 57.1	+13 40.4
	19	103 57.2	39.6
	20	118 57.4	38.8
	21	133 57.5	38.0
	22	148 57.6	37.2
	23	163 57.8	36.4
	24	178 57.9	+13 35.6
code		—	− 8

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.2	−40 29.0
5	Achernar	335 59.6	−57 27.9
30	Acrux	174 00.3	−62 50.8
19	Adhara	255 48.1	−28 54.2
10	Aldebaran	291 41.0	+16 25.2
32	Alioth	167 00.1	+56 12.8
34	Alkaid	153 34.2	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.1	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.8	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.4	−42 33.1
42	Antares	113 21.2	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.2	−68 57.1
22	Avior	234 37.2	−59 21.4
13	Bellatrix	279 20.3	+ 6 18.7
16	Betelg'se	271 50.1	+ 7 24.2
17	Canopus	264 16.5	−52 39.9
12	Capella	281 41.0	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.6	−18 14.2
27	Dubhe	194 47.0	+62 00.2
14	Elnath	279 09.5	+28 34.3
47	Eltanin	91 06.7	+51 29.8
54	Enif	34 30.8	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.6	−56 51.5
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.1	−60 09.4
6	Hamal	328 51.4	+23 14.8
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.7	+74 20.9
57	Markab	14 22.8	+14 57.5
8	Menkar	315 02.0	+ 3 54.8
36	Menkent	149 00.7	−36 08.8
24	Miapl'dus	221 50.5	−69 31.5
9	Mirfak	309 44.7	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.0
38	Rigil Kent.	140 53.5	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.6	+56 17.0
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.5	−16 38.8
33	Spica	159 18.7	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.0	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT h	Equation of Time (App.—Mean) 14 m s	15 m s	16 m s
0	− 4 43.6	− 4 32.5	− 4 20.9
6	− 4 40.9	− 4 29.7	− 4 17.9
12	− 4 38.1	− 4 26.8	− 4 14.9
18	− 4 35.4	− 4 23.9	− 4 11.8
24	− 4 32.5	− 4 20.9	− 4 08.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 14 h m	15 h m	16 h m	17 h m
72	2 22	////	11 28	13 50	▬	▬
70	2 55	////	11 10	13 11	▬	▬
68	3 18	////	10 57	12 45	14 54	▬
66	3 36	////	10 46	12 25	14 15	16 36
64	3 51	////	10 37	12 09	13 48	15 38
62	4 03	////	10 29	11 56	13 28	15 04
60	4 13	////	10 22	11 45	13 11	14 40
58	4 22	////	10 16	11 35	12 57	14 21
56	4 30	1 19	10 11	11 27	12 45	14 04
54	4 37	1 51	10 07	11 20	12 35	13 51
52	4 43	2 14	10 03	11 13	12 25	13 39
50	4 49	2 32	9 59	11 07	12 17	13 28
45	5 01	3 05	9 51	10 55	12 00	13 06
40	5 11	3 28	9 44	10 44	11 46	12 49
35	5 20	3 46	9 38	10 35	11 34	12 34
30	5 27	4 01	9 33	10 27	11 23	12 21
20	5 40	4 23	9 25	10 14	11 05	11 59
10	5 51	4 38	9 17	10 02	10 50	11 41
0	6 01	4 50	9 10	9 51	10 36	11 23
10	6 11	5 00	9 03	9 41	10 21	11 06
20	6 22	5 07	8 55	9 29	10 06	10 47
30	6 34	5 14	8 47	9 16	9 49	10 26
35	6 41	5 16	8 42	9 09	9 39	10 14
40	6 49	5 18	8 37	9 00	9 27	9 59
45	6 58	5 20	8 31	8 51	9 14	9 43
50	7 09	5 20	8 23	8 39	8 58	9 22
52	7 14	5 20	8 20	8 33	8 50	9 12
54	7 19	5 21	8 16	8 27	8 42	9 01
56	7 25	5 20	8 12	8 21	8 32	8 49
58	7 32	5 20	8 07	8 13	8 22	8 35
60	7 40	5 19	8 02	8 05	8 10	8 18
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 14 h m	15 h m	16 h m	17 h m
72	21 41	////	18 47	17 53	▬	▬
70	21 10	////	19 07	18 33	▬	▬
68	20 48	////	19 22	19 01	18 25	▬
66	20 30	////	19 34	19 22	19 04	18 24
64	20 16	////	19 45	19 39	19 32	19 23
62	20 04	////	19 54	19 53	19 54	19 57
60	19 54	////	20 02	20 05	20 11	20 21
58	19 45	23 44	20 08	20 15	20 26	20 41
56	19 37	22 42	20 15	20 25	20 38	20 58
54	19 31	22 13	20 20	20 33	20 49	21 12
52	19 24	21 50	20 25	20 40	20 59	21 24
50	19 19	21 34	20 29	20 46	21 08	21 35
45	19 07	21 02	20 39	21 01	21 26	21 58
40	18 57	20 39	20 47	21 12	21 41	22 17
35	18 49	20 22	20 54	21 22	21 54	22 32
30	18 41	20 07	21 00	21 31	22 06	22 46
20	18 29	19 46	21 11	21 46	22 25	23 09
10	18 18	19 31	21 21	22 00	22 42	23 29
0	18 08	19 19	21 30	22 12	22 58	23 47
10	17 58	19 10	21 39	22 25	23 14	24 06
20	17 47	19 02	21 48	22 38	23 31	24 26
30	17 35	18 56	21 59	22 54	23 51	24 49
35	17 28	18 53	22 06	23 03	24 02	0 02
40	17 21	18 52	22 13	23 13	24 16	0 16
45	17 12	18 51	22 21	23 26	24 32	0 32
50	17 01	18 50	22 32	23 41	24 51	0 51
52	16 56	18 50	22 36	23 48	25 00	1 00
54	16 50	18 50	22 42	23 55	25 11	1 11
56	16 44	18 50	22 47	24 04	0 04	1 23
58	16 37	18 51	22 54	24 14	0 14	1 36
60	16 30	18 52	23 01	24 26	0 26	1 53
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
14	15 20	9 21	11 21	7 51	15 56
15	16 02	9 22	11 20	7 47	15 53
16	16 47	9 23	11 18	7 44	15 49
17	17 35	9 24	11 17	7 41	15 45

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.1	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	14 ′	15 ′	16 ′
0	11.9	12.2	12.8
4	11.9	12.3	12.8
8	11.9	12.3	12.8
12	11.9	12.3	12.8
16	12.0	12.4	12.9
20	12.1	12.4	12.9
24	12.2	12.5	13.0
28	12.2	12.6	13.0
32	12.4	12.7	13.1
36	12.5	12.8	13.2
40	12.6	12.9	13.3
44	12.7	13.0	13.4
48	12.9	13.2	13.5
52	13.1	13.3	13.7
56	13.2	13.5	13.8
60	13.4	13.6	13.9
64	13.6	13.8	14.1
68	13.8	14.0	14.2
72	14.0	14.1	14.3
76	14.2	14.3	14.5
80	14.4	14.5	14.6
84	14.6	14.7	14.8
88	14.7	14.8	14.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	14 ′	15 ′	16 ′
0	17.7	17.4	17.2
4	17.6	17.4	17.1
8	17.6	17.4	17.1
12	17.6	17.4	17.1
16	17.5	17.3	17.0
20	17.5	17.3	17.0
24	17.4	17.2	16.9
28	17.3	17.1	16.9
32	17.2	17.0	16.8
36	17.0	16.9	16.7
40	16.9	16.8	16.6
44	16.8	16.6	16.5
48	16.6	16.5	16.4
52	16.5	16.4	16.2
56	16.3	16.2	16.1
60	16.1	16.1	16.0
64	15.9	15.9	15.8
68	15.8	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.3
84	15.0	15.0	15.1
88	14.8	14.9	15.0
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
17 0	325 04.6	219 10.9	+21 26.2	190 34.8	+18 21.4	244 32.0	+22 34.4	123 02.9	− 6 41.8	104 54.8	122	−21 02.1	− 87
1	340 07.1	234 10.3	26.0	205 35.6	21.0	259 34.0	34.4	138 05.1	41.9	119 26.0	121	21 10.8	− 86
2	355 09.5	249 09.7	25.9	220 36.5	20.6	274 36.1	34.4	153 07.4	41.9	133 57.1	121	21 19.4	− 86
3	10 12.0	264 09.0	•• 25.7	235 37.3	•• 20.1	289 38.1	•• 34.4	168 09.7	•• 42.0	148 28.2	119	•21 28.0	− 85
4	25 14.4	279 08.4	25.5	250 38.2	19.7	304 40.1	34.5	183 12.0	42.1	162 59.1	118	21 36.5	− 83
5	40 16.9	294 07.8	25.4	265 39.0	19.2	319 42.2	34.5	198 14.2	42.2	177 29.9	118	21 44.8	− 83
6	55 19.4	309 07.1	+21 25.2	280 39.9	+18 18.8	334 44.2	+22 34.5	213 16.5	− 6 42.3	192 00.7	117	−21 53.1	− 82
7	70 21.8	324 06.5	25.0	295 40.7	18.4	349 46.2	34.6	228 18.8	42.4	206 31.4	115	22 01.3	− 81
8	85 24.3	339 05.9	24.8	310 41.5	17.9	4 48.3	34.6	243 21.1	42.4	221 01.9	115	22 09.4	− 80
9	100 26.8	354 05.2	•• 24.6	325 42.4	•• 17.5	19 50.3	•• 34.6	258 23.4	•• 42.5	235 32.4	114	•22 17.4	− 79
10	115 29.2	9 04.6	24.5	340 43.2	17.0	34 52.3	34.6	273 25.6	42.6	250 02.8	113	22 25.3	− 77
11	130 31.7	24 04.0	24.3	355 44.1	16.6	49 54.4	34.7	288 27.9	42.7	264 33.1	113	22 33.0	− 77
12	145 34.2	39 03.3	+21 24.1	10 44.9	+18 16.2	64 56.4	+22 34.7	303 30.2	− 6 42.8	279 03.4	111	−22 40.7	− 76
13	160 36.6	54 02.7	23.9	25 45.8	15.7	79 58.4	34.7	318 32.5	42.8	293 33.5	110	22 48.3	− 75
14	175 39.1	69 02.1	23.7	40 46.6	15.3	95 00.5	34.7	333 34.7	42.9	308 03.5	110	22 55.8	− 74
15	190 41.6	84 01.4	•• 23.6	55 47.4	•• 14.8	110 02.5	•• 34.8	348 37.0	•• 43.0	322 33.5	108	•23 03.2	− 73
16	205 44.0	99 00.8	23.4	70 48.3	14.4	125 04.5	34.8	3 39.3	43.1	337 03.3	108	23 10.5	− 72
17	220 46.5	114 00.2	23.2	85 49.1	14.0	140 06.6	34.8	18 41.6	43.2	351 33.1	107	23 17.7	− 71
18	235 48.9	128 59.5	+21 23.0	100 50.0	+18 13.5	155 08.6	+22 34.8	33 43.9	− 6 43.3	6 02.8	106	−23 24.8	− 69
19	250 51.4	143 58.9	22.8	115 50.8	13.1	170 10.6	34.9	48 46.1	43.3	20 32.4	105	23 31.7	− 69
20	265 53.9	158 58.3	22.6	130 51.7	12.6	185 12.7	34.9	63 48.4	43.4	35 01.9	104	23 38.6	− 67
21	280 56.3	173 57.6	•• 22.4	145 52.5	•• 12.2	200 14.7	•• 34.9	78 50.7	•• 43.5	49 31.3	103	•23 45.3	− 67
22	295 58.8	188 57.0	22.2	160 53.4	11.7	215 16.7	34.9	93 53.0	43.6	64 00.6	102	23 52.0	− 65
23	311 01.3	203 56.4	22.1	175 54.2	11.3	230 18.8	35.0	108 55.2	43.7	78 29.8	101	23 58.5	− 64
18 0	326 03.7	218 55.7	+21 21.9	190 55.1	+18 10.9	245 20.8	+22 35.0	123 57.5	− 6 43.8	92 58.9	101	−24 04.9	− 63
1	341 06.2	233 55.1	21.7	205 55.9	10.4	260 22.8	35.0	138 59.8	43.8	107 28.0	99	24 11.2	− 62
2	356 08.7	248 54.5	21.5	220 56.7	10.0	275 24.9	35.0	154 02.1	43.9	121 56.9	99	24 17.4	− 61
3	11 11.1	263 53.8	•• 21.3	235 57.6	•• 09.5	290 26.9	•• 35.1	169 04.3	•• 44.0	136 25.8	97	•24 23.5	− 59
4	26 13.6	278 53.2	21.1	250 58.4	09.1	305 28.9	35.1	184 06.6	44.1	150 54.5	97	24 29.4	− 59
5	41 16.1	293 52.6	20.9	265 59.3	08.6	320 31.0	35.1	199 08.9	44.2	165 23.2	96	24 35.3	− 57
6	56 18.5	308 51.9	+21 20.7	281 00.1	+18 08.2	335 33.0	+22 35.2	214 11.2	− 6 44.3	179 51.8	95	−24 41.0	− 56
7	71 21.0	323 51.3	20.5	296 01.0	07.8	350 35.1	35.2	229 13.5	44.3	194 20.3	94	24 46.6	− 54
8	86 23.4	338 50.7	20.3	311 01.8	07.3	5 37.1	35.2	244 15.7	44.4	208 48.7	93	24 52.0	− 54
9	101 25.9	353 50.0	•• 20.1	326 02.7	•• 06.9	20 39.1	•• 35.2	259 18.0	•• 44.5	223 17.0	92	•24 57.4	− 52
10	116 28.4	8 49.4	19.9	341 03.5	06.4	35 41.2	35.3	274 20.3	44.6	237 45.2	92	25 02.6	− 51
11	131 30.8	23 48.8	19.7	356 04.4	06.0	50 43.2	35.3	289 22.6	44.7	252 13.4	90	25 07.7	− 50
12	146 33.3	38 48.1	+21 19.5	11 05.2	+18 05.5	65 45.2	+22 35.3	304 24.8	− 6 44.8	266 41.4	90	−25 12.7	− 48
13	161 35.8	53 47.5	19.3	26 06.1	05.1	80 47.3	35.3	319 27.1	44.8	281 09.4	89	25 17.5	− 47
14	176 38.2	68 46.9	19.1	41 06.9	04.6	95 49.3	35.4	334 29.4	44.9	295 37.3	88	25 22.2	− 46
15	191 40.7	83 46.2	•• 18.9	56 07.8	•• 04.2	110 51.4	•• 35.4	349 31.7	•• 45.0	310 05.1	87	•25 26.8	− 45
16	206 43.2	98 45.6	18.6	71 08.6	03.7	125 53.4	35.4	4 33.9	45.1	324 32.8	86	25 31.3	− 43
17	221 45.6	113 45.0	18.4	86 09.5	03.3	140 55.4	35.4	19 36.2	45.2	339 00.4	86	25 35.6	− 42
18	236 48.1	128 44.3	+21 18.2	101 10.3	+18 02.8	155 57.5	+22 35.5	34 38.5	− 6 45.3	353 28.0	84	−25 39.8	− 41
19	251 50.5	143 43.7	18.0	116 11.2	02.4	170 59.5	35.5	49 40.8	45.3	7 55.4	84	25 43.9	− 39
20	266 53.0	158 43.0	17.8	131 12.0	02.0	186 01.6	35.5	64 43.0	45.4	22 22.8	83	25 47.8	− 38
21	281 55.5	173 42.4	•• 17.6	146 12.9	•• 01.5	201 03.6	•• 35.5	79 45.3	•• 45.5	36 50.1	82	•25 51.6	− 36
22	296 57.9	188 41.8	17.4	161 13.7	01.1	216 05.6	35.6	94 47.6	45.6	51 17.3	82	25 55.2	− 36
23	312 00.4	203 41.1	17.2	176 14.6	00.6	231 07.7	35.6	109 49.9	45.7	65 44.5	80	25 58.8	− 33
19 0	327 02.9	218 40.5	+21 16.9	191 15.4	+18 00.2	246 09.7	+22 35.6	124 52.1	− 6 45.8	80 11.5	80	−26 02.1	− 33
1	342 05.3	233 39.9	16.7	206 16.3	17 59.7	261 11.8	35.6	139 54.4	45.8	94 38.5	79	26 05.4	− 31
2	357 07.8	248 39.2	16.5	221 17.1	59.3	276 13.8	35.7	154 56.7	45.9	109 05.4	78	26 08.5	− 29
3	12 10.3	263 38.6	•• 16.3	236 18.0	•• 58.8	291 15.8	•• 35.7	169 58.9	•• 46.0	123 32.2	78	•26 11.4	− 28
4	27 12.7	278 38.0	16.1	251 18.8	58.4	306 17.9	35.7	185 01.2	46.1	137 59.0	76	26 14.2	− 27
5	42 15.2	293 37.3	15.8	266 19.7	57.9	321 19.9	35.7	200 03.5	46.2	152 25.6	76	26 16.9	− 25
6	57 17.7	308 36.7	+21 15.6	281 20.5	+17 57.5	336 22.0	+22 35.8	215 05.8	− 6 46.3	166 52.2	75	−26 19.4	− 24
7	72 20.1	323 36.1	15.4	296 21.4	57.0	351 24.0	35.8	230 08.0	46.3	181 18.7	75	26 21.8	− 22
8	87 22.6	338 35.4	15.2	311 22.2	56.6	6 26.0	35.8	245 10.3	46.4	195 45.2	74	26 24.0	− 21
9	102 25.0	353 34.8	•• 14.9	326 23.1	•• 56.1	21 28.1	•• 35.8	260 12.6	•• 46.5	210 11.6	73	•26 26.1	− 19
10	117 27.5	8 34.2	14.7	341 23.9	55.7	36 30.1	35.9	275 14.9	46.6	224 37.9	72	26 28.0	− 18
11	132 30.0	23 33.5	14.5	356 24.8	55.2	51 32.2	35.9	290 17.1	46.7	239 04.1	72	26 29.8	− 17
12	147 32.4	38 32.9	+21 14.3	11 25.6	+17 54.8	66 34.2	+22 35.9	305 19.4	− 6 46.8	253 30.3	71	−26 31.5	− 14
13	162 34.9	53 32.2	14.0	26 26.5	54.3	81 36.3	35.9	320 21.7	46.9	267 56.4	71	26 32.9	− 14
14	177 37.4	68 31.6	13.8	41 27.3	53.9	96 38.3	36.0	335 23.9	46.9	282 22.5	70	26 34.3	− 11
15	192 39.8	83 31.0	•• 13.6	56 28.2	•• 53.4	111 40.4	•• 36.0	350 26.2	•• 47.0	296 48.5	69	•26 35.4	− 11
16	207 42.3	98 30.3	13.3	71 29.0	53.0	126 42.4	36.0	5 28.5	47.1	311 14.4	69	26 36.5	− 8
17	222 44.8	113 29.7	13.1	86 29.9	52.5	141 44.4	36.0	20 30.8	47.2	325 40.3	68	26 37.3	− 7
18	237 47.2	128 29.1	+21 12.9	101 30.7	+17 52.1	156 46.5	+22 36.1	35 33.0	− 6 47.3	340 06.1	67	−26 38.0	− 6
19	252 49.7	143 28.4	12.6	116 31.6	51.6	171 48.5	36.1	50 35.3	47.4	354 31.8	67	26 38.6	− 4
20	267 52.2	158 27.8	12.4	131 32.4	51.2	186 50.6	36.1	65 37.6	47.4	8 57.5	66	26 39.0	− 3
21	282 54.6	173 27.2	•• 12.2	146 33.3	•• 50.7	201 52.6	•• 36.1	80 39.8	•• 47.5	23 23.1	66	•26 39.3	0
22	297 57.1	188 26.5	11.9	161 34.2	50.3	216 54.7	36.1	95 42.1	47.6	37 48.7	66	26 39.3	0
23	312 59.5	203 25.9	11.7	176 35.0	49.8	231 56.7	36.2	110 44.4	47.7	52 14.3	64	26 39.3	+ 3
24	328 02.0	218 25.2	+21 11.4	191 35.9	+17 49.3	246 58.8	+22 36.2	125 46.7	− 6 47.8	66 39.7	65	−26 39.0	+ 4
code	—	− 6	− 2	+ 9	− 4	+ 21	0	+ 23	0				

GMT	SUN GHA	SUN Dec.
17 h 0	178 57.9	+13 35.6
1	193 58.0	34.8
2	208 58.1	34.0
3	223 58.3	33.2
4	238 58.4	32.5
5	253 58.5	31.7
6	268 58.7	+13 30.9
7	283 58.8	30.1
8	298 58.9	29.3
9	313 59.1	28.5
10	328 59.2	27.7
11	343 59.3	26.9
12	358 59.5	+13 26.1
13	13 59.6	25.3
14	28 59.7	24.5
15	43 59.9	23.7
16	59 00.0	22.9
17	74 00.1	22.1
18	89 00.3	+13 21.3
19	104 00.4	20.5
20	119 00.5	19.7
21	134 00.7	18.9
22	149 00.8	18.1
23	164 00.9	17.3
18 0	179 01.1	+13 16.5
1	194 01.2	15.7
2	209 01.3	14.9
3	224 01.5	14.1
4	239 01.6	13.3
5	254 01.7	12.4
6	269 01.9	+13 11.6
7	284 02.0	10.8
8	299 02.1	10.0
9	314 02.3	09.2
10	329 02.4	08.4
11	344 02.6	07.6
12	359 02.7	+13 06.8
13	14 02.8	06.0
14	29 03.0	05.2
15	44 03.1	04.4
16	59 03.3	03.6
17	74 03.4	02.8
18	89 03.5	+13 02.0
19	104 03.7	01.1
20	119 03.8	13 00.3
21	134 03.9	+12 59.5
22	149 04.1	58.7
23	164 04.2	57.9
19 0	179 04.4	+12 57.1
1	194 04.5	56.3
2	209 04.7	55.5
3	224 04.8	54.7
4	239 04.9	53.8
5	254 05.1	53.0
6	269 05.2	+12 52.2
7	284 05.4	51.4
8	299 05.5	50.6
9	314 05.6	49.8
10	329 05.8	49.0
11	344 05.9	48.1
12	359 06.1	+12 47.3
13	14 06.2	46.5
14	29 06.4	45.7
15	44 06.5	44.9
16	59 06.6	44.1
17	74 06.8	43.2
18	89 06.9	+12 42.4
19	104 07.1	41.6
20	119 07.2	40.8
21	134 07.4	40.0
22	149 07.5	39.2
23	164 07.7	38.3
24	179 07.8	+12 37.5
code	—	- 8

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.2	−40 29.0
5	Achernar	335 59.6	−57 27.9
30	Acrux	174 00.3	−62 50.8
19	Adhara	255 48.1	−28 54.2
10	Aldebaran	291 41.0	+16 25.2
32	Alioth	167 00.1	+56 12.8
34	Alkaid	153 34.2	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.0	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 48.9	+26 52.3
1	Alpheratz	358 29.7	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.4	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.3	−68 57.1
22	Avior	234 37.1	−59 21.4
13	Bellatrix	279 20.3	+ 6 18.7
16	Betelg'se	271 50.0	+ 7 24.2
17	Canopus	264 16.4	−52 39.8
12	Capella	281 41.0	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.6	−18 14.2
27	Dubhe	194 47.0	+62 00.2
14	Elnath	279 09.5	+28 34.3
47	Eltanin	91 06.7	+51 29.8
54	Enif	34 30.8	+ 9 39.8
56	Fomalhaut	16 13.0	−29 51.9
31	Gacrux	172 51.6	−56 51.5
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.1	−60 09.3
6	Hamal	328 51.3	+23 14.8
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.8	+74 20.9
57	Markab	14 22.8	+14 57.5
8	Menkar	315 01.9	+ 3 54.8
36	Menkent	149 00.8	−36 08.8
24	Miapl'dus	221 50.5	−69 31.5
9	Mirfak	309 44.7	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.8	+28 08.5
20	Procyon	245 46.9	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.0
38	Rigil Kent.	140 53.5	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.5	+56 17.0
45	Shaula	97 22.6	−37 04.5
18	Sirius	259 13.5	−16 38.8
33	Spica	159 18.8	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.1	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 17 h m	18 h m	19 h m	20 h m
72	2 42	////	■	■	■	■
70	3 10	////	■	■	■	■
68	3 31	////	■	■	■	■
66	3 47	////	16 36	■	■	■
64	4 00	////	15 38	17 53	■	■
62	4 11	////	15 04	16 43	18 06	18 48
60	4 21	////	14 40	16 07	17 22	18 10
58	4 29	0 53	14 21	15 42	16 52	17 43
56	4 36	1 37	14 04	15 22	16 30	17 22
54	4 43	2 04	13 51	15 05	16 11	17 05
52	4 48	2 24	13 39	14 50	15 56	16 50
50	4 54	2 40	13 28	14 38	15 42	16 37
45	5 05	3 11	13 06	14 12	15 14	16 10
40	5 14	3 32	12 49	13 52	14 53	15 49
35	5 22	3 49	12 34	13 35	14 35	15 31
30	5 29	4 03	12 21	13 20	14 19	15 16
20	5 41	4 23	11 59	12 55	13 53	14 50
10	5 51	4 39	11 41	12 34	13 30	14 28
0	6 01	4 50	11 23	12 14	13 09	14 07
10	6 10	4 59	11 06	11 55	12 48	13 46
20	6 20	5 06	10 47	11 33	12 26	13 24
30	6 31	5 11	10 26	11 09	12 00	12 58
35	6 37	5 13	10 14	10 55	11 44	12 42
40	6 44	5 15	9 59	10 38	11 27	12 25
45	6 53	5 15	9 43	10 19	11 05	12 03
50	7 03	5 16	9 22	9 54	10 38	11 36
52	7 08	5 16	9 12	9 43	10 25	11 23
54	7 13	5 15	9 01	9 29	10 10	11 08
56	7 18	5 15	8 49	9 14	9 52	10 50
58	7 25	5 14	8 35	8 56	9 31	10 29
60	7 32	5 13	8 18	8 33	9 04	10 01
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 17 h m	18 h m	19 h m	20 h m
72	21 20	////	■	■	■	■
70	20 54	////	■	■	■	■
68	20 34	////	■	■	■	■
66	20 18	////	18 24	■	■	■
64	20 05	////	19 23	18 56	■	■
62	19 55	////	19 57	20 07	20 39	21 58
60	19 45	////	20 21	20 42	21 23	22 36
58	19 37	23 04	20 41	21 08	21 53	23 02
56	19 30	22 24	20 58	21 28	22 15	23 23
54	19 24	21 59	21 12	21 45	22 34	23 41
52	19 18	21 40	21 24	22 00	22 49	23 55
50	19 13	21 24	21 35	22 13	23 03	24 08
45	19 02	20 55	21 58	22 39	23 31	24 35
40	18 53	20 33	22 17	23 00	23 53	24 56
35	18 45	20 17	22 32	23 17	24 11	0 11
30	18 38	20 03	22 46	23 32	24 26	0 26
20	18 27	19 44	23 09	23 58	24 53	0 53
10	18 17	19 29	23 29	24 20	0 20	1 15
0	18 07	19 18	23 47	24 40	0 40	1 36
10	17 58	19 09	24 06	0 06	1 01	1 58
20	17 48	19 02	24 26	0 26	1 23	2 20
30	17 37	18 58	24 49	0 49	1 48	2 46
35	17 31	18 56	0 02	1 03	2 04	3 02
40	17 24	18 55	0 16	1 19	2 21	3 20
45	17 15	18 54	0 32	1 38	2 42	3 41
50	17 05	18 54	0 51	2 02	3 09	4 08
52	17 01	18 55	1 00	2 13	3 22	4 22
54	16 56	18 55	1 11	2 26	3 37	4 37
56	16 50	18 56	1 23	2 41	3 54	4 55
58	16 44	18 57	1 36	2 59	4 15	5 17
60	16 37	18 58	1 53	3 21	4 42	5 45
S						

Equation of Time (App.—Mean)

GMT h	17 m s	18 m s	19 m s
0	− 4 08.7	− 3 56.0	− 3 42.8
6	− 4 05.6	− 3 52.8	− 3 39.4
12	− 4 02.5	− 3 49.5	− 3 36.0
18	− 3 59.3	− 3 46.2	− 3 32.5
24	− 3 56.0	− 3 42.8	− 3 29.1

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
17	17 35	9 24	11 17	7 41	15 45
18	18 27	9 25	11 16	7 38	15 42
19	19 23	9 26	11 14	7 34	15 38
20	20 21	9 27	11 13	7 31	15 35

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.0	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	17 ′	18 ′	19 ′
0	13.4	14.3	15.4
4	13.4	14.3	15.4
8	13.4	14.3	15.4
12	13.4	14.3	15.4
16	13.5	14.3	15.4
20	13.5	14.4	15.4
24	13.6	14.4	15.4
28	13.6	14.4	15.4
32	13.7	14.4	15.4
36	13.7	14.5	15.4
40	13.8	14.5	15.4
44	13.9	14.6	15.5
48	14.0	14.6	15.5
52	14.1	14.7	15.5
56	14.2	14.7	15.5
60	14.3	14.8	15.5
64	14.4	14.9	15.5
68	14.5	14.9	15.5
72	14.6	15.0	15.5
76	14.7	15.1	15.5
80	14.9	15.1	15.5
84	15.0	15.2	15.5
88	15.1	15.3	15.5
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	17 ′	18 ′	19 ′
0	16.8	16.3	15.6
4	16.8	16.3	15.6
8	16.8	16.3	15.6
12	16.7	16.2	15.6
16	16.7	16.2	15.6
20	16.7	16.2	15.6
24	16.6	16.2	15.6
28	16.6	16.1	15.6
32	16.5	16.1	15.6
36	16.4	16.1	15.6
40	16.4	16.0	15.6
44	16.3	16.0	15.6
48	16.2	15.9	15.6
52	16.1	15.9	15.6
56	16.0	15.8	15.6
60	15.9	15.7	15.6
64	15.8	15.7	15.6
68	15.7	15.6	15.6
72	15.6	15.6	15.6
76	15.4	15.5	15.5
80	15.3	15.4	15.5
84	15.2	15.3	15.5
88	15.1	15.3	15.5
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
20 0	328 02.0	218 25.2	+21 11.4	191 35.9	+17 49.3	246 58.8	+22 36.2	125 46.7	− 6 47.8	66 39.7	65	−26 39.0	+ 4
1	343 04.5	233 24.6	11.2	206 36.7	48.9	262 00.8	36.2	140 48.9	47.9	81 05.2	64	26 38.6	+ 5
2	358 06.9	248 24.0	11.0	221 37.6	48.4	277 02.8	36.2	155 51.2	47.9	95 30.6	63	26 38.1	+ 7
3	13 09.4	263 23.3	•• 10.7	236 38.4	•• 48.0	292 04.9	•• 36.3	170 53.5	•• 48.0	109 55.9	63	•26 37.4	+ 9
4	28 11.9	278 22.7	10.5	251 39.3	47.5	307 06.9	36.3	185 55.7	48.1	124 21.2	62	26 36.5	+ 10
5	43 14.3	293 22.1	10.2	266 40.1	47.1	322 09.0	36.3	200 58.0	48.2	138 46.4	63	26 35.5	+ 12
6	58 16.8	308 21.4	+21 10.0	281 41.0	+17 46.6	337 11.0	+22 36.3	216 00.3	− 6 48.3	153 11.7	61	−26 34.3	+ 14
7	73 19.3	323 20.8	09.7	296 41.8	46.2	352 13.1	36.4	231 02.6	48.4	167 36.8	62	26 32.9	+ 15
8	88 21.7	338 20.2	09.5	311 42.7	45.7	7 15.1	36.4	246 04.8	48.5	182 02.0	61	26 31.4	+ 17
9	103 24.2	353 19.5	•• 09.2	326 43.6	•• 45.3	22 17.2	•• 36.4	261 07.1	•• 48.5	196 27.1	60	•26 29.7	+ 19
10	118 26.7	8 18.9	09.0	341 44.4	44.8	37 19.2	36.4	276 09.4	48.6	210 52.1	61	26 27.8	+ 20
11	133 29.1	23 18.2	08.7	356 45.3	44.4	52 21.3	36.5	291 11.6	48.7	225 17.2	60	26 25.8	+ 22
12	148 31.6	38 17.6	+21 08.5	11 46.1	+17 43.9	67 23.3	+22 36.5	306 13.9	− 6 48.8	239 42.2	59	−26 23.6	+ 23
13	163 34.0	53 17.0	08.2	26 47.0	43.4	82 25.4	36.5	321 16.2	48.9	254 07.1	60	26 21.3	+ 26
14	178 36.5	68 16.3	08.0	41 47.8	43.0	97 27.4	36.5	336 18.4	49.0	268 32.1	59	26 18.7	+ 27
15	193 39.0	83 15.7	•• 07.7	56 48.7	•• 42.5	112 29.5	•• 36.6	351 20.7	•• 49.1	282 57.0	59	•26 16.0	+ 28
16	208 41.4	98 15.1	07.4	71 49.6	42.1	127 31.5	36.6	6 23.0	49.1	297 21.9	58	26 13.2	+ 30
17	223 43.9	113 14.4	07.2	86 50.4	41.6	142 33.6	36.6	21 25.3	49.2	311 46.7	59	26 10.2	+ 32
18	238 46.4	128 13.8	+21 06.9	101 51.3	+17 41.2	157 35.6	+22 36.6	36 27.5	− 6 49.3	326 11.6	58	−26 07.0	+ 34
19	253 48.8	143 13.1	06.7	116 52.1	40.7	172 37.7	36.7	51 29.8	49.4	340 36.4	58	26 03.6	+ 35
20	268 51.3	158 12.5	06.4	131 53.0	40.2	187 39.7	36.7	66 32.1	49.5	355 01.2	58	26 00.1	+ 37
21	283 53.8	173 11.9	•• 06.1	146 53.8	•• 39.8	202 41.8	•• 36.7	81 34.3	•• 49.6	9 26.0	58	•25 56.4	+ 38
22	298 56.2	188 11.2	05.9	161 54.7	39.3	217 43.8	36.7	96 36.6	49.7	23 50.8	58	25 52.6	+ 41
23	313 58.7	203 10.6	05.6	176 55.6	38.9	232 45.9	36.7	111 38.9	49.7	38 15.6	57	25 48.5	+ 42
21 0	329 01.2	218 10.0	+21 05.4	191 56.4	+17 38.4	247 47.9	+22 36.8	126 41.1	− 6 49.8	52 40.3	58	−25 44.3	+ 43
1	344 03.6	233 09.3	05.1	206 57.3	38.0	262 50.0	36.8	141 43.4	49.9	67 05.1	57	25 40.0	+ 46
2	359 06.1	248 08.7	04.8	221 58.1	37.5	277 52.0	36.8	156 45.7	50.0	81 29.8	58	25 35.4	+ 47
3	14 08.5	263 08.1	•• 04.6	236 59.0	•• 37.0	292 54.1	•• 36.8	171 47.9	•• 50.1	95 54.6	57	•25 30.7	+ 48
4	29 11.0	278 07.4	04.3	251 59.8	36.6	307 56.1	36.9	186 50.2	50.2	110 19.3	57	25 25.9	+ 51
5	44 13.5	293 06.8	04.0	267 00.7	36.1	322 58.2	36.9	201 52.5	50.2	124 44.0	57	25 20.8	+ 52
6	59 15.9	308 06.1	+21 03.7	282 01.6	+17 35.7	338 00.2	+22 36.9	216 54.7	− 6 50.3	139 08.7	58	−25 15.6	+ 53
7	74 18.4	323 05.5	03.5	297 02.4	35.2	353 02.3	36.9	231 57.0	50.4	153 33.5	57	25 10.3	+ 56
8	89 20.9	338 04.9	03.2	312 03.3	34.8	8 04.3	37.0	246 59.3	50.5	167 58.2	57	25 04.7	+ 57
9	104 23.3	353 04.2	•• 02.9	327 04.1	•• 34.3	23 06.4	•• 37.0	262 01.5	•• 50.6	182 22.9	58	•24 59.0	+ 58
10	119 25.8	8 03.6	02.7	342 05.0	33.8	38 08.4	37.0	277 03.8	50.7	196 47.7	57	24 53.2	+ 61
11	134 28.3	23 03.0	02.4	357 05.9	33.4	53 10.5	37.0	292 06.1	50.8	211 12.4	58	24 47.1	+ 62
12	149 30.7	38 02.3	+21 02.1	12 06.7	+17 32.9	68 12.6	+22 37.0	307 08.4	− 6 50.9	225 37.2	58	−24 40.9	+ 63
13	164 33.2	53 01.7	01.8	27 07.6	32.5	83 14.6	37.1	322 10.6	50.9	240 02.0	57	24 34.6	+ 66
14	179 35.6	68 01.0	01.5	42 08.4	32.0	98 16.7	37.1	337 12.9	51.0	254 26.7	58	24 28.0	+ 67
15	194 38.1	83 00.4	•• 01.3	57 09.3	•• 31.5	113 18.7	•• 37.1	352 15.2	•• 51.1	268 51.5	58	•24 21.3	+ 68
16	209 40.6	97 59.8	01.0	72 10.2	31.1	128 20.8	37.1	7 17.4	51.2	283 16.3	58	24 14.5	+ 70
17	224 43.0	112 59.1	00.7	87 11.0	30.6	143 22.8	37.2	22 19.7	51.3	297 41.1	59	24 07.5	+ 72
18	239 45.5	127 58.5	+21 00.4	102 11.9	+17 30.1	158 24.9	+22 37.2	37 22.0	− 6 51.4	312 06.0	58	−24 00.3	+ 74
19	254 48.0	142 57.9	21 00.1	117 12.8	29.7	173 26.9	37.2	52 24.2	51.5	326 30.8	59	23 52.9	+ 75
20	269 50.4	157 57.2	20 59.8	132 13.6	29.2	188 29.0	37.2	67 26.5	51.5	340 55.7	59	23 45.4	+ 77
21	284 52.9	172 56.6	•• 59.6	147 14.5	•• 28.8	203 31.1	•• 37.3	82 28.8	•• 51.6	355 20.6	59	•23 37.7	+ 78
22	299 55.4	187 55.9	59.3	162 15.3	28.3	218 33.1	37.3	97 31.0	51.7	9 45.5	60	23 29.9	+ 80
23	314 57.8	202 55.3	59.0	177 16.2	27.8	233 35.2	37.3	112 33.3	51.8	24 10.5	60	23 21.9	+ 82
22 0	330 00.3	217 54.7	+20 58.7	192 17.1	+17 27.4	248 37.2	+22 37.3	127 35.6	− 6 51.9	38 35.5	60	−23 13.7	+ 83
1	345 02.8	232 54.0	58.4	207 17.9	26.9	263 39.3	37.3	142 37.8	52.0	53 00.5	60	23 05.4	+ 84
2	0 05.2	247 53.4	58.1	222 18.8	26.5	278 41.3	37.4	157 40.1	52.1	67 25.5	60	22 57.0	+ 87
3	15 07.7	262 52.8	•• 57.8	237 19.6	•• 26.0	293 43.4	•• 37.4	172 42.3	•• 52.1	81 50.5	61	•22 48.3	+ 88
4	30 10.1	277 52.1	57.5	252 20.5	25.5	308 45.5	37.4	187 44.6	52.2	96 15.6	61	22 39.5	+ 89
5	45 12.6	292 51.5	57.2	267 21.4	25.1	323 47.5	37.4	202 46.9	52.3	110 40.7	62	22 30.6	+ 91
6	60 15.1	307 50.8	+20 56.9	282 22.2	+17 24.6	338 49.6	+22 37.5	217 49.1	− 6 52.4	125 05.9	62	−22 21.5	+ 93
7	75 17.5	322 50.2	56.6	297 23.1	24.1	353 51.6	37.5	232 51.4	52.5	139 31.1	62	22 12.2	+ 94
8	90 20.0	337 49.6	56.4	312 24.0	23.7	8 53.7	37.5	247 53.7	52.6	153 56.3	62	22 02.8	+ 95
9	105 22.5	352 48.9	•• 56.1	327 24.8	•• 23.2	23 55.7	•• 37.5	262 55.9	•• 52.7	168 21.5	63	•21 53.3	+ 97
10	120 24.9	7 48.3	55.8	342 25.7	22.7	38 57.8	37.5	277 58.2	52.8	182 46.8	63	21 43.6	+ 99
11	135 27.4	22 47.7	55.5	357 26.6	22.3	53 59.9	37.6	293 00.5	52.8	197 12.1	64	21 33.7	+100
12	150 29.9	37 47.0	+20 55.2	12 27.4	+17 21.8	69 01.9	+22 37.6	308 02.7	− 6 52.9	211 37.5	64	−21 23.7	+102
13	165 32.3	52 46.4	54.8	27 28.3	21.3	84 04.0	37.6	323 05.0	53.0	226 02.9	64	21 13.5	+103
14	180 34.8	67 45.8	54.5	42 29.1	20.9	99 06.0	37.6	338 07.3	53.1	240 28.3	65	21 03.2	+104
15	195 37.3	82 45.1	•• 54.2	57 30.0	•• 20.4	114 08.1	•• 37.7	353 09.5	•• 53.2	254 53.8	66	•20 52.8	+106
16	210 39.7	97 44.5	53.9	72 30.9	20.0	129 10.2	37.7	8 11.8	53.3	269 19.4	65	20 42.2	+107
17	225 42.2	112 43.8	53.6	87 31.7	19.5	144 12.2	37.7	23 14.1	53.4	283 44.9	66	20 31.5	+109
18	240 44.6	127 43.2	+20 53.3	102 32.6	+17 19.0	159 14.3	+22 37.7	38 16.3	− 6 53.4	298 10.5	67	−20 20.6	+111
19	255 47.1	142 42.6	53.0	117 33.5	18.6	174 16.3	37.8	53 18.6	53.5	312 36.2	67	20 09.5	+111
20	270 49.6	157 41.9	52.7	132 34.3	18.1	189 18.4	37.8	68 20.8	53.6	327 01.9	67	19 58.4	+113
21	285 52.0	172 41.3	•• 52.4	147 35.2	•• 17.6	204 20.5	•• 37.8	83 23.1	•• 53.7	341 27.6	68	•19 47.1	+115
22	300 54.5	187 40.7	52.1	162 36.1	17.2	219 22.5	37.8	98 25.4	53.8	355 53.4	68	19 35.6	+115
23	315 57.0	202 40.0	51.8	177 36.9	16.7	234 24.6	37.8	113 27.6	53.9	10 19.2	69	19 24.1	+118
24	330 59.4	217 39.4	+20 51.5	192 37.8	+17 16.2	249 26.7	+22 37.9	128 29.9	− 6 54.0	24 45.1	69	−19 12.3	+118
code		− 6	− 3	+ 9	− 4	+ 20	+ 1	+ 22	0				

GMT	h	SUN GHA ° ′	Dec. ° ′
20	0	179 07.8	+12 37.5
	1	194 08.0	36.7
	2	209 08.1	35.9
	3	224 08.2	·· 35.1
	4	239 08.4	34.2
	5	254 08.5	33.4
	6	269 08.7	+12 32.6
	7	284 08.8	31.8
	8	299 09.0	30.9
	9	314 09.1	·· 30.1
	10	329 09.3	29.3
	11	344 09.4	28.5
	12	359 09.6	+12 27.7
	13	14 09.7	26.8
	14	29 09.9	26.0
	15	44 10.0	·· 25.2
	16	59 10.2	24.4
	17	74 10.3	23.5
	18	89 10.5	+12 22.7
	19	104 10.6	21.9
	20	119 10.8	21.1
	21	134 10.9	·· 20.2
	22	149 11.1	19.4
	23	164 11.2	18.6
21	0	179 11.4	+12 17.7
	1	194 11.5	16.9
	2	209 11.7	16.1
	3	224 11.8	·· 15.3
	4	239 12.0	14.4
	5	254 12.1	13.6
	6	269 12.3	+12 12.8
	7	284 12.4	11.9
	8	299 12.6	11.1
	9	314 12.7	·· 10.3
	10	329 12.9	09.4
	11	344 13.0	08.6
	12	359 13.2	+12 07.8
	13	14 13.3	07.0
	14	29 13.5	06.1
	15	44 13.7	·· 05.3
	16	59 13.8	04.5
	17	74 14.0	03.6
	18	89 14.1	+12 02.8
	19	104 14.3	02.0
	20	119 14.4	01.1
	21	134 14.6	·12 00.3
	22	149 14.7	11 59.4
	23	164 14.9	58.6
22	0	179 15.1	+11 57.8
	1	194 15.2	56.9
	2	209 15.4	56.1
	3	224 15.5	·· 55.3
	4	239 15.7	54.4
	5	254 15.8	53.6
	6	269 16.0	+11 52.8
	7	284 16.1	51.9
	8	299 16.3	51.1
	9	314 16.5	·· 50.2
	10	329 16.6	49.4
	11	344 16.8	48.6
	12	359 16.9	+11 47.7
	13	14 17.1	46.9
	14	29 17.3	46.0
	15	44 17.4	·· 45.2
	16	59 17.6	44.4
	17	74 17.7	43.5
	18	89 17.9	+11 42.7
	19	104 18.0	41.8
	20	119 18.2	41.0
	21	134 18.4	·· 40.2
	22	149 18.5	39.3
	23	164 18.7	38.5
24		179 18.9	+11 37.6
code		—	- 8

No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.2	−40 29.0
5	Achernar	335 59.5	−57 27.9
30	Acrux	174 00.3	−62 50.8
19	Adhara	255 48.1	−28 54.2
10	Aldebaran	291 41.0	+16 25.2
32	Alioth	167 00.2	+56 12.8
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.4	−47 11.0
15	Alnilam	276 32.0	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.4	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.3	−68 57.1
22	Avior	234 37.1	−59 21.4
13	Bellatrix	279 20.3	+ 6 18.7
16	Betelg'se	271 50.0	+ 7 24.2
17	Canopus	264 16.4	−52 39.8
12	Capella	281 41.0	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.6	−18 14.1
27	Dubhe	194 47.0	+62 00.2
14	Elnath	279 09.5	+28 34.3
47	Eltanin	91 06.7	+51 29.8
54	Enif	34 30.8	+ 9 39.8
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.6	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.1	−60 09.3
6	Hamal	328 51.3	+23 14.8
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.8	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.9	+ 3 54.8
36	Menkent	149 00.8	−36 08.8
24	Miapl'dus	221 50.5	−69 31.5
9	Mirfak	309 44.7	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.8	+28 08.4
20	Procyon	245 46.9	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.0
38	Rigil Kent.	140 53.5	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.5	+56 17.0
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.5	−16 38.8
33	Spica	159 18.8	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.1	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 20	21	22
h	m s	m s	m s
0	− 3 29.1	− 3 14.8	− 3 00.1
6	− 3 25.6	− 3 11.2	− 2 56.4
12	− 3 22.0	− 3 07.5	− 2 52.6
18	− 3 18.4	− 3 03.8	− 2 48.8
24	− 3 14.8	− 3 00.1	− 2 44.9

Lat.	Sunrise	Twlt. begins	Moonrise 20	21	22	23
N °	h m	h m	h m	h m	h m	h m
72	3 01	////	▬	▬	▬	20 46
70	3 25	////	▬	▬	21 42	20 16
68	3 43	////	▬	▬	20 31	19 53
66	3 57	////	▬	20 46	19 54	19 35
64	4 09	////	▬	19 38	19 27	19 20
62	4 19	////	18 48	19 02	19 06	19 07
60	4 28	////	18 10	18 36	18 49	18 57
58	4 35	1 18	17 43	18 15	18 35	18 48
56	4 42	1 51	17 22	17 58	18 22	18 39
54	4 48	2 14	17 05	17 44	18 12	18 32
52	4 53	2 33	16 50	17 31	18 02	18 25
50	4 58	2 48	16 37	17 20	17 53	18 19
45	5 08	3 16	16 10	16 57	17 35	18 06
40	5 17	3 36	15 49	16 38	17 20	17 56
35	5 24	3 52	15 31	16 22	17 07	17 46
30	5 31	4 05	15 16	16 08	16 56	17 38
20	5 42	4 25	14 50	15 45	16 36	17 24
10	5 51	4 39	14 28	15 24	16 19	17 12
0	6 00	4 50	14 07	15 05	16 04	17 00
10	6 08	4 58	13 46	14 46	15 48	16 48
20	6 18	5 04	13 24	14 26	15 31	16 36
30	6 28	5 09	12 58	14 02	15 11	16 21
35	6 34	5 10	12 42	13 48	14 59	16 13
40	6 40	5 11	12 25	13 32	14 46	16 03
45	6 48	5 10	12 03	13 13	14 30	15 52
50	6 57	5 10	11 36	12 48	14 11	15 38
52	7 02	5 09	11 23	12 37	14 01	15 32
54	7 06	5 09	11 08	12 23	13 51	15 25
56	7 11	5 08	10 50	12 08	13 39	15 16
58	7 17	5 06	10 29	11 49	13 25	15 07
60	7 24	5 05	10 01	11 26	13 09	14 57
S						

Lat.	Sunset	Twlt. ends	Moonset 20	21	22	23
N °	h m	h m	h m	h m	h m	h m
72	21 01	////	▬	▬	▬	▬
70	20 38	////	▬	▬	23 12	26 36
68	20 21	////	▬	▬	▬	0 21
66	20 07	////	▬	22 05	24 58	0 58
64	19 55	////	▬	23 12	25 23	1 23
62	19 45	////	21 58	23 47	25 43	1 43
60	19 37	23 48	22 36	24 12	0 12	1 59
58	19 29	22 39	23 02	24 32	0 32	2 13
56	19 23	22 09	23 23	24 49	0 49	2 24
54	19 17	21 47	23 41	25 03	1 03	2 34
52	19 12	21 30	23 55	25 15	1 15	2 43
50	19 07	21 15	24 08	0 08	1 26	2 52
45	18 57	20 48	24 35	0 35	1 48	3 08
40	18 49	20 28	24 56	0 56	2 07	3 22
35	18 42	20 13	0 11	1 13	2 22	3 34
30	18 35	20 00	0 26	1 28	2 35	3 44
20	18 24	19 40	0 53	1 53	2 57	4 02
10	18 15	19 27	1 15	2 15	3 16	4 17
0	18 06	19 16	1 36	2 35	3 33	4 30
10	17 58	19 09	1 58	2 55	3 51	4 44
20	17 49	19 03	2 20	3 16	4 10	4 59
30	17 39	18 59	2 46	3 41	4 31	5 16
35	17 33	18 58	3 02	3 56	4 43	5 25
40	17 26	18 57	3 20	4 12	4 58	5 36
45	17 19	18 57	3 41	4 32	5 15	5 49
50	17 10	18 58	4 08	4 57	5 35	6 05
52	17 05	18 58	4 22	5 09	5 45	6 12
54	17 01	19 00	4 37	5 23	5 56	6 20
56	16 56	19 01	4 55	5 39	6 09	6 29
58	16 50	19 02	5 17	5 58	6 23	6 39
60	16 44	19 05	5 45	6 21	6 40	6 50
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
20	20 21	9 27	11 13	7 31	15 35
21	21 19	9 28	11 12	7 28	15 31
22	22 17	9 29	11 10	7 25	15 27
23	23 13	9 30	11 09	7 21	15 24

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.1	0.1	0.1
30	0.1	0.1	0.0
45	0.1	0.1	0.0
60	0.1	0.0	0.0
75	0.1	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	20	21	22
°	′	′	′
0	16.6	17.7	18.9
4	16.6	17.7	18.8
8	16.6	17.7	18.8
12	16.5	17.7	18.8
16	16.5	17.6	18.7
20	16.5	17.6	18.7
24	16.5	17.5	18.6
28	16.5	17.5	18.5
32	16.4	17.4	18.4
36	16.4	17.4	18.3
40	16.4	17.3	18.2
44	16.3	17.2	18.1
48	16.3	17.1	17.9
52	16.2	17.0	17.8
56	16.2	16.9	17.6
60	16.1	16.8	17.5
64	16.1	16.7	17.3
68	16.0	16.6	17.1
72	16.0	16.5	17.0
76	15.9	16.4	16.8
80	15.9	16.3	16.6
84	15.8	16.1	16.4
88	15.8	16.0	16.3
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	20	21	22
°	′	′	′
0	15.0	14.3	13.7
4	15.0	14.3	13.7
8	15.0	14.3	13.7
12	15.0	14.4	13.7
16	15.0	14.4	13.8
20	15.0	14.4	13.8
24	15.0	14.5	13.9
28	15.1	14.5	14.0
32	15.1	14.6	14.1
36	15.1	14.7	14.2
40	15.2	14.8	14.3
44	15.2	14.8	14.5
48	15.3	14.9	14.6
52	15.3	15.0	14.7
56	15.3	15.1	14.9
60	15.4	15.2	15.0
64	15.4	15.3	15.2
68	15.5	15.4	15.4
72	15.5	15.5	15.5
76	15.6	15.7	15.7
80	15.7	15.8	15.9
84	15.7	15.9	16.1
88	15.8	16.0	16.2
90			

Subtract from table, back cover

GMT	♈	VENUS −3.5		MARS 2.0		JUPITER −1.8		SATURN 1.0		MOON			
	GHA	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
23 0	330 59.4	217 39.4	+20 51.5	192 37.8	+17 16.2	249 26.7	+22 37.9	128 29.9	− 6 54.0	24 45.1	69	−19 12.3	+118
1	346 01.9	232 38.7	51.1	207 38.7	15.8	264 28.7	37.9	143 32.2	54.1	39 11.0	70	19 00.5	+120
2	1 04.4	247 38.1	50.8	222 39.5	15.3	279 30.8	37.9	158 34.4	54.1	53 37.0	70	18 48.5	+121
3	16 06.8	262 37.5	•• 50.5	237 40.4	•• 14.8	294 32.8	•• 37.9	173 36.7	•• 54.2	68 03.0	71	•18 36.4	+122
4	31 09.3	277 36.8	50.2	252 41.3	14.4	309 34.9	37.9	188 39.0	54.3	82 29.1	71	18 24.2	+124
5	46 11.8	292 36.2	49.9	267 42.1	13.9	324 37.0	38.0	203 41.2	54.4	96 55.2	71	18 11.8	+125
6	61 14.2	307 35.6	+20 49.6	282 43.0	+17 13.4	339 39.0	+22 38.0	218 43.5	− 6 54.5	111 21.3	72	−17 59.3	+126
7	76 16.7	322 34.9	49.2	297 43.9	12.9	354 41.1	38.0	233 45.7	54.6	125 47.5	73	17 46.7	+127
8	91 19.1	337 34.3	48.9	312 44.7	12.5	9 43.2	38.0	248 48.0	54.7	140 13.8	73	17 34.0	+129
9	106 21.6	352 33.6	•• 48.6	327 45.6	•• 12.0	24 45.2	•• 38.1	263 50.3	•• 54.8	154 40.1	73	•17 21.1	+130
10	121 24.1	7 33.0	48.3	342 46.5	11.5	39 47.3	38.1	278 52.5	54.8	169 06.4	74	17 08.1	+131
11	136 26.5	22 32.4	48.0	357 47.3	11.1	54 49.3	38.1	293 54.8	54.9	183 32.8	75	16 55.0	+132
12	151 29.0	37 31.7	+20 47.6	12 48.2	+17 10.6	69 51.4	+22 38.1	308 57.1	− 6 55.0	197 59.3	75	−16 41.8	+134
13	166 31.5	52 31.1	47.3	27 49.1	10.1	84 53.5	38.1	323 59.3	55.1	212 25.8	76	16 28.4	+134
14	181 33.9	67 30.5	47.0	42 49.9	09.7	99 55.5	38.2	339 01.6	55.2	226 52.4	76	16 15.0	+136
15	196 36.4	82 29.8	•• 46.6	57 50.8	•• 09.2	114 57.6	•• 38.2	354 03.8	•• 55.3	241 19.0	76	•16 01.4	+137
16	211 38.9	97 29.2	46.3	72 51.7	08.7	129 59.7	38.2	9 06.1	55.4	255 45.6	77	15 47.7	+138
17	226 41.3	112 28.6	46.0	87 52.6	08.3	145 01.7	38.2	24 08.4	55.5	270 12.3	77	15 33.9	+139
18	241 43.8	127 27.9	+20 45.7	102 53.4	+17 07.8	160 03.8	+22 38.3	39 10.6	− 6 55.5	284 39.0	78	−15 20.0	+140
19	256 46.2	142 27.3	45.3	117 54.3	07.3	175 05.9	38.3	54 12.9	55.6	299 05.8	79	15 06.0	+141
20	271 48.7	157 26.6	45.0	132 55.2	06.8	190 07.9	38.3	69 15.1	55.7	313 32.7	79	14 51.9	+142
21	286 51.2	172 26.0	•• 44.7	147 56.0	•• 06.4	205 10.0	•• 38.3	84 17.4	•• 55.8	327 59.6	79	•14 37.7	+143
22	301 53.6	187 25.4	44.3	162 56.9	05.9	220 12.1	38.3	99 19.7	55.9	342 26.5	80	14 23.4	+144
23	316 56.1	202 24.7	44.0	177 57.8	05.4	235 14.1	38.4	114 21.9	56.0	356 53.5	80	14 09.0	+145
24 0	331 58.6	217 24.1	+20 43.6	192 58.6	+17 05.0	250 16.2	+22 38.4	129 24.2	− 6 56.1	11 20.5	81	−13 54.5	+146
1	347 01.0	232 23.5	43.3	207 59.5	04.5	265 18.3	38.4	144 26.4	56.2	25 47.6	81	13 39.9	+147
2	2 03.5	247 22.8	43.0	223 00.4	04.0	280 20.3	38.4	159 28.7	56.2	40 14.7	82	13 25.2	+148
3	17 06.0	262 22.2	•• 42.6	238 01.3	•• 03.5	295 22.4	•• 38.4	174 31.0	•• 56.3	54 41.9	82	•13 10.4	+149
4	32 08.4	277 21.6	42.3	253 02.1	03.1	310 24.5	38.5	189 33.2	56.4	69 09.1	83	12 55.5	+150
5	47 10.9	292 20.9	41.9	268 03.0	02.6	325 26.5	38.5	204 35.5	56.5	83 36.4	83	12 40.5	+150
6	62 13.4	307 20.3	+20 41.6	283 03.9	+17 02.1	340 28.6	+22 38.5	219 37.7	− 6 56.6	98 03.7	84	−12 25.5	+152
7	77 15.8	322 19.6	41.3	298 04.7	01.7	355 30.7	38.5	234 40.0	56.7	112 31.1	84	12 10.3	+152
8	92 18.3	337 19.0	40.9	313 05.6	01.2	10 32.8	38.5	249 42.3	56.8	126 58.5	84	11 55.1	+153
9	107 20.7	352 18.4	•• 40.6	328 06.5	•• 00.7	25 34.8	•• 38.6	264 44.5	•• 56.9	141 25.9	85	•11 39.8	+154
10	122 23.2	7 17.7	40.2	343 07.4	17 00.2	40 36.9	38.6	279 46.8	57.0	155 53.4	85	11 24.4	+154
11	137 25.7	22 17.1	39.9	358 08.2	16 59.8	55 39.0	38.6	294 49.0	57.0	170 20.9	86	11 09.0	+156
12	152 28.1	37 16.5	+20 39.5	13 09.1	+16 59.3	70 41.0	+22 38.6	309 51.3	− 6 57.1	184 48.5	86	−10 53.4	+156
13	167 30.6	52 15.8	39.2	28 10.0	58.8	85 43.1	38.7	324 53.6	57.2	199 16.1	87	10 37.8	+157
14	182 33.1	67 15.2	38.8	43 10.8	58.3	100 45.2	38.7	339 55.8	57.3	213 43.8	87	10 22.1	+157
15	197 35.5	82 14.6	•• 38.5	58 11.7	•• 57.9	115 47.2	•• 38.7	354 58.1	•• 57.4	228 11.5	87	•10 06.4	+159
16	212 38.0	97 13.9	38.1	73 12.6	57.4	130 49.3	38.7	10 00.3	57.5	242 39.2	88	9 50.5	+159
17	227 40.5	112 13.3	37.8	88 13.5	56.9	145 51.4	38.7	25 02.6	57.6	257 07.0	88	9 34.6	+159
18	242 42.9	127 12.7	+20 37.4	103 14.3	+16 56.4	160 53.5	+22 38.8	40 04.9	− 6 57.7	271 34.8	88	− 9 18.7	+160
19	257 45.4	142 12.0	37.1	118 15.2	56.0	175 55.5	38.8	55 07.1	57.8	286 02.6	89	9 02.7	+161
20	272 47.9	157 11.4	36.7	133 16.1	55.5	190 57.6	38.8	70 09.4	57.8	300 30.5	89	8 46.6	+162
21	287 50.3	172 10.7	•• 36.3	148 16.9	•• 55.0	205 59.7	•• 38.8	85 11.6	•• 57.9	314 58.4	90	• 8 30.4	+162
22	302 52.8	187 10.1	36.0	163 17.8	54.5	221 01.7	38.8	100 13.9	58.0	329 26.4	90	8 14.2	+162
23	317 55.2	202 09.5	35.6	178 18.7	54.1	236 03.8	38.9	115 16.2	58.1	343 54.4	90	7 58.0	+163
25 0	332 57.7	217 08.8	+20 35.3	193 19.6	+16 53.6	251 05.9	+22 38.9	130 18.4	− 6 58.2	358 22.4	91	− 7 41.7	+164
1	348 00.2	232 08.2	34.9	208 20.4	53.1	266 08.0	38.9	145 20.7	58.3	12 50.5	90	7 25.3	+164
2	3 02.6	247 07.6	34.5	223 21.3	52.6	281 10.0	38.9	160 22.9	58.4	27 18.5	92	7 08.9	+164
3	18 05.1	262 06.9	•• 34.2	238 22.2	•• 52.2	296 12.1	•• 38.9	175 25.2	•• 58.5	41 46.7	91	• 6 52.5	+165
4	33 07.6	277 06.3	33.8	253 23.1	51.7	311 14.2	39.0	190 27.4	58.6	56 14.8	92	6 36.0	+165
5	48 10.0	292 05.7	33.4	268 23.9	51.2	326 16.3	39.0	205 29.7	58.6	70 43.0	92	6 19.5	+166
6	63 12.5	307 05.0	+20 33.1	283 24.8	+16 50.7	341 18.3	+22 39.0	220 32.0	− 6 58.7	85 11.2	92	− 6 02.9	+166
7	78 15.0	322 04.4	32.7	298 25.7	50.2	356 20.4	39.0	235 34.2	58.8	99 39.4	93	5 46.3	+167
8	93 17.4	337 03.8	32.3	313 26.6	49.8	11 22.5	39.0	250 36.5	58.9	114 07.7	93	5 29.6	+167
9	108 19.9	352 03.1	•• 32.0	328 27.4	•• 49.3	26 24.6	•• 39.1	265 38.7	•• 59.0	128 36.0	93	• 5 12.9	+167
10	123 22.3	7 02.5	31.6	343 28.3	48.8	41 26.6	39.1	280 41.0	59.1	143 04.3	93	4 56.2	+168
11	138 24.8	22 01.9	31.2	358 29.2	48.3	56 28.7	39.1	295 43.2	59.2	157 32.6	94	4 39.4	+167
12	153 27.3	37 01.2	+20 30.9	13 30.1	+16 47.9	71 30.8	+22 39.1	310 45.5	− 6 59.3	172 01.0	94	− 4 22.7	+169
13	168 29.7	52 00.6	30.5	28 30.9	47.4	86 32.9	39.1	325 47.8	59.4	186 29.4	94	4 05.8	+168
14	183 32.2	67 00.0	30.1	43 31.8	46.9	101 34.9	39.2	340 50.0	59.4	200 57.8	94	3 49.0	+169
15	198 34.7	81 59.3	•• 29.7	58 32.7	•• 46.4	116 37.0	•• 39.2	355 52.3	•• 59.5	215 26.2	95	• 3 32.1	+168
16	213 37.1	96 58.7	29.4	73 33.6	45.9	131 39.1	39.2	10 54.5	59.6	229 54.7	94	3 15.3	+169
17	228 39.6	111 58.0	29.0	88 34.4	45.5	146 41.2	39.2	25 56.8	59.7	244 23.1	95	2 58.4	+169
18	243 42.1	126 57.4	+20 28.6	103 35.3	+16 45.0	161 43.2	+22 39.2	40 59.0	− 6 59.8	258 51.6	95	− 2 41.5	+170
19	258 44.5	141 56.8	28.2	118 36.2	44.5	176 45.3	39.3	56 01.3	6 59.9	273 20.1	95	2 24.5	+169
20	273 47.0	156 56.1	27.8	133 37.1	44.0	191 47.4	39.3	71 03.6	7 00.0	287 48.6	95	2 07.6	+170
21	288 49.5	171 55.5	•• 27.5	148 38.0	•• 43.5	206 49.5	•• 39.3	86 05.8	•• 00.1	302 17.1	96	• 1 50.6	+169
22	303 51.9	186 54.9	27.1	163 38.8	43.1	221 51.6	39.3	101 08.1	00.2	316 45.7	95	1 33.7	+170
23	318 54.4	201 54.2	26.7	178 39.7	42.6	236 53.6	39.3	116 10.3	00.2	331 14.2	96	1 16.7	+170
24	333 56.8	216 53.6	+20 26.3	193 40.6	+16 42.1	251 55.7	+22 39.4	131 12.6	− 7 00.3	345 42.8	96	− 0 59.7	+170
code	−	− 7	− 3	+ 9	− 5	+ 21	+ 1	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
23 0	179 18.9	+11 37.6
1	194 19.0	36.8
2	209 19.2	35.9
3	224 19.3	35.1
4	239 19.5	34.2
5	254 19.7	33.4
6	269 19.8	+11 32.6
7	284 20.0	31.7
8	299 20.1	30.9
9	314 20.3	30.0
10	329 20.5	29.2
11	344 20.6	28.3
12	359 20.8	+11 27.5
13	14 21.0	26.6
14	29 21.1	25.8
15	44 21.3	24.9
16	59 21.4	24.1
17	74 21.6	23.2
18	89 21.8	+11 22.4
19	104 21.9	21.5
20	119 22.1	20.7
21	134 22.3	19.8
22	149 22.4	19.0
23	164 22.6	18.1
24 0	179 22.8	+11 17.3
1	194 22.9	16.4
2	209 23.1	15.6
3	224 23.3	14.7
4	239 23.4	13.9
5	254 23.6	13.0
6	269 23.8	+11 12.2
7	284 23.9	11.3
8	299 24.1	10.5
9	314 24.3	09.6
10	329 24.4	08.8
11	344 24.6	07.9
12	359 24.8	+11 07.1
13	14 24.9	06.2
14	29 25.1	05.3
15	44 25.3	04.5
16	59 25.4	03.6
17	74 25.6	02.8
18	89 25.8	+11 01.9
19	104 25.9	01.1
20	119 26.1	11 00.2
21	134 26.3	+10 59.3
22	149 26.4	58.5
23	164 26.6	57.6
25 0	179 26.8	+10 56.8
1	194 27.0	55.9
2	209 27.1	55.1
3	224 27.3	54.2
4	239 27.5	53.3
5	254 27.6	52.5
6	269 27.8	+10 51.6
7	284 28.0	50.8
8	299 28.1	49.9
9	314 28.3	49.0
10	329 28.5	48.2
11	344 28.7	47.3
12	359 28.8	+10 46.4
13	14 29.0	45.6
14	29 29.2	44.7
15	44 29.3	43.9
16	59 29.5	43.0
17	74 29.7	42.1
18	89 29.9	+10 41.3
19	104 30.0	40.4
20	119 30.2	39.5
21	134 30.4	38.7
22	149 30.6	37.8
23	164 30.7	36.9
24	179 30.9	+10 36.1
code	—	- 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.1	−40 28.9
5	Achernar	335 59.5	−57 27.9
30	Acrux	174 00.3	−62 50.8
19	Adhara	255 48.0	−28 54.2
10	Aldebaran	291 40.9	+16 25.2
32	Alioth	167 00.2	+56 12.8
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.3	−47 11.0
15	Alnilam	276 32.0	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.4	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.3	−68 57.1
22	Avior	234 37.1	−59 21.4
13	Bellatrix	279 20.2	+ 6 18.7
16	Betelg'se	271 50.0	+ 7 24.2
17	Canopus	264 16.4	−52 39.8
12	Capella	281 40.9	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 47.0	+62 00.2
14	Elnath	279 09.5	+28 34.3
47	Eltanin	91 06.7	+51 29.8
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.6	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.1	−60 09.3
6	Hamal	328 51.3	+23 14.8
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.9	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.9	+ 3 54.8
36	Menkent	149 00.8	−36 08.8
24	Miapl'dus	221 50.5	−69 31.5
9	Mirfak	309 44.6	+49 41.8
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.8	+28 08.4
20	Procyon	245 46.9	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.3	− 8 15.0
38	Rigil Kent.	140 53.5	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.5	+56 17.0
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.5	−16 38.8
33	Spica	159 18.8	−10 55.3
23	Suhail	223 26.0	−43 14.6
49	Vega	81 09.1	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 23	24	25
h	m s	m s	m s
0	− 2 44.9	− 2 29.3	− 2 13.2
6	− 2 41.1	− 2 25.3	− 2 09.1
12	− 2 37.2	− 2 21.3	− 2 05.0
18	− 2 33.2	− 2 17.3	− 2 00.9
24	− 2 29.3	− 2 13.2	− 1 56.7

Lat.	Sunrise	Twlt. begins	Moonrise 23	24	25	26
N °	h m	h m	h m	h m	h m	h m
72	3 18	////	20 46	19 54	19 18	18 45
70	3 39	////	20 16	19 41	19 15	18 51
68	3 55	////	19 53	19 30	19 12	18 55
66	4 07	////	19 35	19 21	19 10	18 59
64	4 18	////	19 20	19 14	19 08	19 03
62	4 27	////	19 07	19 07	19 06	19 05
60	4 35	0 53	18 57	19 01	19 05	19 08
58	4 42	1 37	18 48	18 56	19 04	19 10
56	4 48	2 04	18 39	18 52	19 02	19 13
54	4 53	2 24	18 32	18 48	19 01	19 14
52	4 58	2 41	18 25	18 44	19 00	19 16
50	5 02	2 55	18 19	18 40	18 59	19 17
45	5 12	3 21	18 06	18 33	18 57	19 21
40	5 20	3 41	17 56	18 27	18 56	19 24
35	5 26	3 56	17 46	18 21	18 54	19 26
30	5 32	4 08	17 38	18 17	18 53	19 28
20	5 42	4 26	17 24	18 08	18 51	19 32
10	5 51	4 39	17 12	18 01	18 49	19 36
0	5 59	4 49	17 00	17 54	18 47	19 39
10	6 07	4 56	16 48	17 47	18 45	19 42
20	6 15	5 02	16 36	17 40	18 43	19 46
30	6 24	5 06	16 21	17 32	18 41	19 50
35	6 30	5 06	16 13	17 27	18 40	19 53
40	6 36	5 06	16 03	17 21	18 38	19 55
45	6 43	5 07	15 52	17 15	18 37	19 59
50	6 51	5 05	15 38	17 07	18 35	20 02
52	6 55	5 04	15 32	17 03	18 34	20 04
54	6 59	5 03	15 25	16 59	18 33	20 06
56	7 04	5 01	15 16	16 55	18 32	20 09
58	7 09	5 00	15 07	16 50	18 31	20 11
60	7 15	4 58	14 57	16 44	18 29	20 14
S						

Lat.	Sunset	Twlt. ends	Moonset 23	24	25	26
N °	h m	h m	h m	h m	h m	h m
72	20 43	////	■	2 08	4 54	7 24
70	20 23	////	26 36	2 36	5 04	7 23
68	20 07	////	0 21	2 57	5 12	7 21
66	19 55	////	0 58	3 13	5 19	7 21
64	19 45	////	1 23	3 27	5 25	7 20
62	19 36	////	1 43	3 38	5 30	7 19
60	19 28	23 01	1 59	3 47	5 34	7 18
58	19 21	22 20	2 13	3 56	5 37	7 18
56	19 16	21 55	2 24	4 03	5 40	7 17
54	19 10	21 35	2 34	4 09	5 43	7 17
52	19 06	21 20	2 43	4 15	5 46	7 17
50	19 01	21 06	2 52	4 20	5 48	7 16
45	18 52	20 41	3 08	4 31	5 54	7 16
40	18 44	20 22	3 22	4 40	5 58	7 15
35	18 38	20 08	3 34	4 48	6 01	7 14
30	18 32	19 56	3 44	4 55	6 05	7 14
20	18 22	19 38	4 02	5 06	6 10	7 13
10	18 14	19 26	4 17	5 17	6 15	7 12
0	18 06	19 16	4 30	5 26	6 19	7 11
10	17 58	19 09	4 44	5 35	6 24	7 11
20	17 50	19 04	4 59	5 45	6 28	7 10
30	17 41	19 01	5 16	5 56	6 33	7 09
35	17 35	19 00	5 25	6 02	6 36	7 08
40	17 29	19 00	5 36	6 10	6 40	7 08
45	17 22	19 00	5 49	6 18	6 43	7 07
50	17 14	19 02	6 05	6 28	6 48	7 06
52	17 10	19 03	6 12	6 33	6 50	7 06
54	17 06	19 04	6 20	6 38	6 52	7 05
56	17 02	19 07	6 29	6 43	6 54	7 05
58	16 57	19 09	6 39	6 49	6 57	7 04
60	16 51	19 11	6 50	6 56	7 00	7 03
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
23	23 13	9 30	11 09	7 21	15 24
24	24 07	9 31	11 07	7 18	15 20
25	0 07	9 32	11 06	7 15	15 17
26	0 59	9 33	11 05	7 11	15 13

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	23	24	25
°	′	′	′
0	19.9	20.5	20.9
4	19.9	20.5	20.9
8	19.8	20.5	20.8
12	19.8	20.4	20.8
16	19.7	20.3	20.7
20	19.6	20.2	20.6
24	19.5	20.1	20.5
28	19.4	20.0	20.3
32	19.3	19.8	20.2
36	19.2	19.7	20.0
40	19.0	19.5	19.8
44	18.8	19.3	19.6
48	18.7	19.1	19.4
52	18.5	18.9	19.2
56	18.3	18.7	18.9
60	18.1	18.4	18.7
64	17.9	18.2	18.4
68	17.6	17.9	18.1
72	17.4	17.7	17.9
76	17.2	17.4	17.6
80	17.0	17.2	17.3
84	16.7	16.9	17.0
88	16.5	16.7	16.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	23	24	25
°	′	′	′
0	13.1	12.7	12.5
4	13.1	12.7	12.5
8	13.1	12.8	12.6
12	13.2	12.8	12.6
16	13.2	12.9	12.7
20	13.3	13.0	12.8
24	13.4	13.1	12.9
28	13.5	13.2	13.1
32	13.7	13.4	13.2
36	13.8	13.5	13.4
40	13.9	13.7	13.6
44	14.1	13.9	13.8
48	14.3	14.1	14.0
52	14.5	14.3	14.2
56	14.7	14.5	14.5
60	14.9	14.8	14.7
64	15.1	15.0	15.0
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.0	16.1	16.1
84	16.2	16.3	16.4
88	16.4	16.5	16.6
90			

Subtract from table, back cover

Full Moon 24

918768°—52——11

GMT	♈ GHA	VENUS −3.5 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
26 0	333 56.8	216 53.6	+20 26.3	193 40.6	+16 42.1	251 55.7	+22 39.4	131 12.6	− 7 00.3	345 42.8	96	− 0 59.7	+170
1	348 59.3	231 53.0	25.9	208 41.5	41.6	266 57.8	39.4	146 14.8	00.4	0 11.4	96	0 42.7	+170
2	4 01.8	246 52.3	25.5	223 42.3	41.1	281 59.9	39.4	161 17.1	00.5	14 40.0	95	0 25.7	+169
3	19 04.2	261 51.7	•• 25.1	238 43.2	•• 40.7	297 02.0	•• 39.4	176 19.3	•• 00.6	29 08.5	96	− 0 08.8	+170
4	34 06.7	276 51.1	24.8	253 44.1	40.2	312 04.0	39.4	191 21.6	00.7	43 37.1	96	+ 0 08.2	+170
5	49 09.2	291 50.4	24.4	268 45.0	39.7	327 06.1	39.5	206 23.9	00.8	58 05.7	97	0 25.2	+170
6	64 11.6	306 49.8	+20 24.0	283 45.9	+16 39.2	342 08.2	+22 39.5	221 26.1	− 7 00.9	72 34.4	96	+ 0 42.2	+169
7	79 14.1	321 49.2	23.6	298 46.7	38.7	357 10.3	39.5	236 28.4	01.0	87 03.0	96	0 59.1	+170
8	94 16.6	336 48.5	23.2	313 47.6	38.3	12 12.4	39.5	251 30.6	01.1	101 31.6	96	1 16.1	+169
9	109 19.0	351 47.9	•• 22.8	328 48.5	•• 37.8	27 14.4	•• 39.5	266 32.9	•• 01.1	116 00.2	96	• 1 33.0	+169
10	124 21.5	6 47.3	22.4	343 49.4	37.3	42 16.5	39.6	281 35.1	01.2	130 28.8	97	1 49.9	+169
11	139 24.0	21 46.6	22.0	358 50.3	36.8	57 18.6	39.6	296 37.4	01.3	144 57.5	96	2 06.8	+169
12	154 26.4	36 46.0	+20 21.6	13 51.1	+16 36.3	72 20.7	+22 39.6	311 39.6	− 7 01.4	159 26.1	96	+ 2 23.7	+169
13	169 28.9	51 45.4	21.2	28 52.0	35.8	87 22.8	39.6	326 41.9	01.5	173 54.7	96	2 40.6	+168
14	184 31.3	66 44.7	20.8	43 52.9	35.4	102 24.8	39.6	341 44.1	01.6	188 23.3	96	2 57.4	+168
15	199 33.8	81 44.1	•• 20.4	58 53.8	•• 34.9	117 26.9	•• 39.7	356 46.4	•• 01.7	202 51.9	96	• 3 14.2	+168
16	214 36.3	96 43.5	20.0	73 54.6	34.4	132 29.0	39.7	11 48.7	01.8	217 20.5	96	3 31.0	+168
17	229 38.7	111 42.8	19.6	88 55.5	33.9	147 31.1	39.7	26 50.9	01.9	231 49.1	96	3 47.8	+167
18	244 41.2	126 42.2	+20 19.2	103 56.4	+16 33.4	162 33.2	+22 39.7	41 53.2	− 7 02.0	246 17.7	96	+ 4 04.5	+168
19	259 43.7	141 41.6	18.8	118 57.3	32.9	177 35.3	39.7	56 55.4	02.0	260 46.3	96	4 21.3	+166
20	274 46.1	156 40.9	18.4	133 58.2	32.5	192 37.3	39.8	71 57.7	02.1	275 14.9	96	4 37.9	+167
21	289 48.6	171 40.3	•• 18.0	148 59.1	•• 32.0	207 39.4	•• 39.8	86 59.9	•• 02.2	289 43.5	95	• 4 54.6	+166
22	304 51.1	186 39.7	17.6	163 59.9	31.5	222 41.5	39.8	102 02.2	02.3	304 12.0	96	5 11.2	+165
23	319 53.5	201 39.1	17.2	179 00.8	31.0	237 43.6	39.8	117 04.4	02.4	318 40.6	95	5 27.7	+165
27 0	334 56.0	216 38.4	+20 16.8	194 01.7	+16 30.5	252 45.7	+22 39.8	132 06.7	− 7 02.5	333 09.1	95	+ 5 44.2	+165
1	349 58.4	231 37.8	16.4	209 02.6	30.0	267 47.8	39.9	147 08.9	02.6	347 37.6	95	6 00.7	+165
2	5 00.9	246 37.2	15.9	224 03.5	29.5	282 49.8	39.9	162 11.2	02.7	2 06.1	95	6 17.2	+163
3	20 03.4	261 36.5	•• 15.5	239 04.3	•• 29.1	297 51.9	•• 39.9	177 13.4	•• 02.8	16 34.6	95	• 6 33.5	+164
4	35 05.8	276 35.9	15.1	254 05.2	28.6	312 54.0	39.9	192 15.7	02.9	31 03.1	94	6 49.9	+163
5	50 08.3	291 35.3	14.7	269 06.1	28.1	327 56.1	39.9	207 17.9	03.0	45 31.5	95	7 06.2	+162
6	65 10.8	306 34.6	+20 14.3	284 07.0	+16 27.6	342 58.2	+22 39.9	222 20.2	− 7 03.0	60 00.0	94	+ 7 22.4	+162
7	80 13.2	321 34.0	13.9	299 07.9	27.1	358 00.3	40.0	237 22.5	03.1	74 28.4	94	7 38.6	+161
8	95 15.7	336 33.4	13.5	314 08.8	26.6	13 02.4	40.0	252 24.7	03.2	88 56.8	93	7 54.7	+161
9	110 18.2	351 32.7	•• 13.0	329 09.6	•• 26.1	28 04.4	•• 40.0	267 27.0	••• 03.3	103 25.1	94	• 8 10.8	+160
10	125 20.6	6 32.1	12.6	344 10.5	25.7	43 06.5	40.0	282 29.2	03.4	117 53.5	93	8 26.8	+159
11	140 23.1	21 31.5	12.2	359 11.4	25.2	58 08.6	40.0	297 31.5	03.5	132 21.8	93	8 42.7	+159
12	155 25.6	36 30.8	+20 11.8	14 12.3	+16 24.7	73 10.7	+22 40.1	312 33.7	− 7 03.6	146 50.1	93	+ 8 58.6	+159
13	170 28.0	51 30.2	11.4	29 13.2	24.2	88 12.8	40.1	327 36.0	03.7	161 18.4	93	9 14.5	+157
14	185 30.5	66 29.6	10.9	44 14.1	23.7	103 14.9	40.1	342 38.2	03.8	175 46.7	92	9 30.2	+157
15	200 32.9	81 28.9	•• 10.5	59 14.9	•• 23.2	118 17.0	•• 40.1	357 40.5	•• 03.9	190 14.9	92	• 9 45.9	+156
16	215 35.4	96 28.3	10.1	74 15.8	22.7	133 19.1	40.1	12 42.7	04.0	204 43.1	92	10 01.5	+156
17	230 37.9	111 27.7	09.7	89 16.7	22.3	148 21.1	40.2	27 45.0	04.0	219 11.3	91	10 17.1	+154
18	245 40.3	126 27.1	+20 09.2	104 17.6	+16 21.8	163 23.2	+22 40.2	42 47.2	− 7 04.1	233 39.4	92	+10 32.5	+154
19	260 42.8	141 26.4	08.8	119 18.5	21.3	178 25.3	40.2	57 49.5	04.2	248 07.6	90	10 47.9	+154
20	275 45.3	156 25.8	08.4	134 19.4	20.8	193 27.4	40.2	72 51.7	04.3	262 35.6	91	11 03.3	+152
21	290 47.7	171 25.2	•• 08.0	149 20.2	•• 20.3	208 29.5	•• 40.2	87 54.0	•• 04.4	277 03.7	90	•11 18.5	+152
22	305 50.2	186 24.5	07.5	164 21.1	19.8	223 31.6	40.2	102 56.2	04.5	291 31.7	90	11 33.7	+151
23	320 52.7	201 23.9	07.1	179 22.0	19.3	238 33.7	40.3	117 58.5	04.6	305 59.7	90	11 48.8	+150
28 0	335 55.1	216 23.3	+20 06.7	194 22.9	+16 18.8	253 35.8	+22 40.3	133 00.7	− 7 04.7	320 27.7	89	+12 03.8	+149
1	350 57.6	231 22.7	06.2	209 23.8	18.3	268 37.9	40.3	148 03.0	04.8	334 55.6	89	12 18.7	+148
2	6 00.0	246 22.0	05.8	224 24.7	17.9	283 40.0	40.3	163 05.2	04.9	349 23.5	89	12 33.5	+148
3	21 02.5	261 21.4	•• 05.4	239 25.6	•• 17.4	298 42.0	•• 40.3	178 07.5	•• 05.0	3 51.4	88	•12 48.3	+146
4	36 05.0	276 20.8	04.9	254 26.4	16.9	313 44.1	40.4	193 09.7	05.0	18 19.2	88	13 02.9	+146
5	51 07.4	291 20.1	04.5	269 27.3	16.4	328 46.2	40.4	208 12.0	05.1	32 47.0	87	13 17.5	+145
6	66 09.9	306 19.5	+20 04.1	284 28.2	+16 15.9	343 48.3	+22 40.4	223 14.2	− 7 05.2	47 14.7	88	+13 32.0	+143
7	81 12.4	321 18.9	03.6	299 29.1	15.4	358 50.4	40.4	238 16.5	05.3	61 42.5	86	13 46.3	+143
8	96 14.8	336 18.2	03.2	314 30.0	14.9	13 52.5	40.4	253 18.7	05.4	76 10.1	87	14 00.6	+142
9	111 17.3	351 17.6	•• 02.7	329 30.9	•• 14.4	28 54.6	•• 40.5	268 21.0	•• 05.5	90 37.8	86	•14 14.8	+141
10	126 19.8	6 17.0	02.3	344 31.8	13.9	43 56.7	40.5	283 23.2	05.6	105 05.4	86	14 28.9	+140
11	141 22.2	21 16.4	01.9	359 32.6	13.4	58 58.8	40.5	298 25.5	05.7	119 33.0	85	14 42.9	+139
12	156 24.7	36 15.7	+20 01.4	14 33.5	+16 12.9	74 00.9	+22 40.5	313 27.7	− 7 05.8	134 00.5	85	+14 56.8	+137
13	171 27.2	51 15.1	01.0	29 34.4	12.5	89 03.0	40.5	328 30.0	05.9	148 28.0	84	15 10.5	+137
14	186 29.6	66 14.5	00.5	44 35.3	12.0	104 05.1	40.5	343 32.2	06.0	162 55.4	84	15 24.2	+136
15	201 32.1	81 13.8	•20 00.1	59 36.2	•• 11.5	119 07.2	•• 40.6	358 34.5	•• 06.1	177 22.8	84	•15 37.8	+135
16	216 34.5	96 13.2	19 59.6	74 37.1	11.0	134 09.3	40.6	13 36.7	06.1	191 50.2	83	15 51.3	+133
17	231 37.0	111 12.6	59.2	89 38.0	10.5	149 11.3	40.6	28 39.0	06.2	206 17.5	83	16 04.6	+133
18	246 39.5	126 12.0	+19 58.7	104 38.9	+16 10.0	164 13.4	+22 40.6	43 41.2	− 7 06.3	220 44.8	83	+16 17.9	+131
19	261 41.9	141 11.3	58.3	119 39.7	09.5	179 15.5	40.6	58 43.5	06.4	235 12.1	82	16 31.0	+130
20	276 44.4	156 10.7	57.8	134 40.6	09.0	194 17.6	40.6	73 45.7	06.5	249 39.3	81	16 44.0	+129
21	291 46.9	171 10.1	•• 57.4	149 41.5	•• 08.5	209 19.7	•• 40.7	88 48.0	•• 06.6	264 06.4	82	•16 56.9	+128
22	306 49.3	186 09.5	56.9	164 42.4	08.0	224 21.8	40.7	103 50.2	06.7	278 33.6	80	17 09.7	+127
23	321 51.8	201 08.8	56.5	179 43.3	07.5	239 23.9	40.7	118 52.5	06.8	293 00.6	81	17 22.4	+126
24	336 54.3	216 08.2	+19 56.0	194 44.2	+16 07.0	254 26.0	+22 40.7	133 54.7	− 7 06.9	307 27.7	80	+17 35.0	+124
code	−	− 6	− 4	+ 9	− 5	+ 21	0	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
26 h 0	179 30.9	+10 36.1
1	194 31.1	35.2
2	209 31.3	34.3
3	224 31.4	33.5
4	239 31.6	32.6
5	254 31.8	31.7
6	269 32.0	+10 30.9
7	284 32.1	30.0
8	299 32.3	29.1
9	314 32.5	28.3
10	329 32.7	27.4
11	344 32.8	26.5
12	359 33.0	+10 25.7
13	14 33.2	24.8
14	29 33.4	23.9
15	44 33.5	23.1
16	59 33.7	22.2
17	74 33.9	21.3
18	89 34.1	+10 20.5
19	104 34.2	19.6
20	119 34.4	18.7
21	134 34.6	17.8
22	149 34.8	17.0
23	164 35.0	16.1
27 0	179 35.1	+10 15.2
1	194 35.3	14.3
2	209 35.5	13.5
3	224 35.7	12.6
4	239 35.8	11.7
5	254 36.0	10.9
6	269 36.2	+10 10.0
7	284 36.4	09.1
8	299 36.6	08.2
9	314 36.7	07.4
10	329 36.9	06.5
11	344 37.1	05.6
12	359 37.3	+10 04.7
13	14 37.5	03.9
14	29 37.6	03.0
15	44 37.8	02.1
16	59 38.0	01.2
17	74 38.2	10 00.3
18	89 38.4	+ 9 59.5
19	104 38.5	58.6
20	119 38.7	57.7
21	134 38.9	56.8
22	149 39.1	56.0
23	164 39.3	55.1
28 0	179 39.4	+ 9 54.2
1	194 39.6	53.3
2	209 39.8	52.4
3	224 40.0	51.6
4	239 40.2	50.7
5	254 40.4	49.8
6	269 40.5	+ 9 48.9
7	284 40.7	48.0
8	299 40.9	47.2
9	314 41.1	46.3
10	329 41.3	45.4
11	344 41.5	44.5
12	359 41.6	+ 9 43.6
13	14 41.8	42.7
14	29 42.0	41.9
15	44 42.2	41.0
16	59 42.4	40.1
17	74 42.6	39.2
18	89 42.7	+ 9 38.3
19	104 42.9	37.4
20	119 43.1	36.6
21	134 43.3	35.7
22	149 43.5	34.8
23	164 43.7	33.9
24	179 43.9	+ 9 33.0
code	—	- 8

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.1	−40 28.9
5	Achernar	335 59.5	−57 27.9
30	Acrux	174 00.4	−62 50.8
19	Adhara	255 48.0	−28 54.2
10	Aldebaran	291 40.9	+16 25.2
32	Alioth	167 00.2	+56 12.8
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 32.0	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.4	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.7	+19 25.5
43	Atria	109 03.4	−68 57.1
22	Avior	234 37.1	−59 21.4
13	Bellatrix	279 20.2	+ 6 18.7
16	Betelg'se	271 50.0	+ 7 24.2
17	Canopus	264 16.4	−52 39.8
12	Capella	281 40.9	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 47.0	+62 00.1
14	Elnath	279 09.4	+28 34.3
47	Eltanin	91 06.7	+51 29.8
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.6	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.2	−60 09.3
6	Hamal	328 51.3	+23 14.8
48	Kaus Aust.	84 43.0	−34 24.6
40	Kochab	137 17.9	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.9	+ 3 54.8
36	Menkent	149 00.8	−36 08.8
24	Miapl'dus	221 50.5	−69 31.5
9	Mirfak	309 44.6	+49 41.9
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.8	+28 08.4
20	Procyon	245 46.9	+ 5 20.8
46	R'alhague	96 47.9	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.2	− 8 15.0
38	Rigil Kent.	140 53.6	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.5	+56 17.0
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.4	−16 38.8
33	Spica	159 18.8	−10 55.3
23	Suhail	223 26.0	−43 14.5
49	Vega	81 09.1	+38 44.6
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 26	27	28
h	m s	m s	m s
0	− 1 56.7	− 1 39.8	− 1 22.6
6	− 1 52.5	− 1 35.6	− 1 18.2
12	− 1 48.3	− 1 31.3	− 1 13.8
18	− 1 44.1	− 1 26.9	− 1 09.4
24	− 1 39.8	− 1 22.6	− 1 05.0

Lat.	Sunrise	Twlt. begins	Moonrise 26	27	28	29
N	h m	h m	h m	h m	h m	h m
72	3 34	////	18 45	18 08	17 09	▭
70	3 52	////	18 51	18 24	17 47	▭
68	4 06	////	18 55	18 37	18 14	17 30
66	4 18	////	18 59	18 48	18 35	18 15
64	4 27	////	19 03	18 57	18 51	18 45
62	4 35	////	19 05	19 05	19 05	19 08
60	4 42	1 19	19 08	19 12	19 17	19 26
58	4 48	1 53	19 10	19 18	19 27	19 42
56	4 54	2 16	19 13	19 23	19 37	19 55
54	4 59	2 35	19 14	19 28	19 45	20 06
52	5 03	2 49	19 16	19 33	19 52	20 16
50	5 07	3 02	19 17	19 37	19 59	20 26
45	5 16	3 26	19 21	19 45	20 13	20 45
40	5 23	3 45	19 24	19 53	20 24	21 01
35	5 29	3 59	19 26	19 59	20 34	21 14
30	5 34	4 10	19 28	20 05	20 43	21 26
20	5 43	4 27	19 32	20 15	20 59	21 46
10	5 51	4 40	19 36	20 23	21 12	22 04
0	5 58	4 49	19 39	20 31	21 25	22 21
10	6 05	4 55	19 42	20 40	21 38	22 37
20	6 13	5 00	19 46	20 49	21 52	22 55
30	6 21	5 02	19 50	20 59	22 08	23 16
35	6 26	5 02	19 53	21 05	22 17	23 29
40	6 32	5 03	19 55	21 12	22 28	23 43
45	6 38	5 02	19 59	21 20	22 41	24 00
50	6 45	5 00	20 02	21 30	22 57	24 21
52	6 49	4 58	20 04	21 34	23 04	24 31
54	6 53	4 57	20 06	21 39	23 12	24 42
56	6 57	4 55	20 09	21 45	23 21	24 55
58	7 01	4 53	20 11	21 51	23 32	25 11
60	7 07	4 50	20 14	21 58	23 44	25 29
S						

Lat.	Sunset	Twlt. ends	Moonset 26	27	28	29
N	h m	h m	h m	h m	h m	h m
72	20 25	////	7 24	9 54	12 47	▭
70	20 08	////	7 23	9 41	12 11	▭
68	19 54	////	7 21	9 30	11 46	14 25
66	19 43	////	7 21	9 22	11 26	13 41
64	19 34	////	7 20	9 14	11 11	13 12
62	19 26	23 39	7 19	9 08	10 58	12 50
60	19 19	22 35	7 18	9 03	10 48	12 33
58	19 13	22 04	7 18	8 58	10 38	12 18
56	19 08	21 42	7 17	8 54	10 30	12 06
54	19 03	21 24	7 17	8 50	10 23	11 55
52	18 59	21 10	7 17	8 47	10 17	11 45
50	18 55	20 58	7 16	8 44	10 11	11 37
45	18 47	20 35	7 16	8 37	9 58	11 19
40	18 40	20 17	7 15	8 32	9 48	11 04
35	18 34	20 03	7 14	8 27	9 39	10 52
30	18 29	19 52	7 14	8 23	9 32	10 41
20	18 20	19 35	7 13	8 16	9 19	10 22
10	18 12	19 23	7 12	8 10	9 07	10 06
0	18 05	19 15	7 11	8 04	8 57	9 51
10	17 58	19 08	7 11	7 58	8 46	9 36
20	17 50	19 04	7 10	7 52	8 35	9 21
30	17 42	19 02	7 09	7 45	8 22	9 02
35	17 37	19 01	7 08	7 41	8 15	8 52
40	17 32	19 02	7 08	7 36	8 06	8 40
45	17 26	19 04	7 07	7 31	7 56	8 26
50	17 18	19 06	7 06	7 25	7 45	8 09
52	17 15	19 08	7 06	7 22	7 39	8 01
54	17 11	19 09	7 05	7 19	7 33	7 52
56	17 07	19 11	7 05	7 15	7 27	7 42
58	17 03	19 14	7 04	7 11	7 20	7 31
60	16 58	19 17	7 03	7 07	7 11	7 18
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
26	0 59	9 33	11 05	7 11	15 13
27	1 51	9 34	11 03	7 08	15 09
28	2 44	9 35	11 02	7 05	15 06
29	3 38	9 36	11 00	7 01	15 02

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	26	27	28
°	′	′	′
0	20.8	20.3	19.5
4	20.7	20.2	19.5
8	20.7	20.2	19.5
12	20.6	20.1	19.4
16	20.6	20.1	19.3
20	20.5	20.0	19.3
24	20.4	19.9	19.2
28	20.2	19.8	19.1
32	20.1	19.6	19.0
36	19.9	19.5	18.8
40	19.7	19.3	18.7
44	19.5	19.1	18.5
48	19.3	18.9	18.4
52	19.1	18.7	18.2
56	18.8	18.5	18.0
60	18.6	18.3	17.9
64	18.3	18.1	17.7
68	18.1	17.8	17.5
72	17.8	17.6	17.2
76	17.5	17.3	17.0
80	17.2	17.1	16.8
84	17.0	16.8	16.6
88	16.7	16.6	16.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	26	27	28
°	′	′	′
0	12.6	12.9	13.3
4	12.6	12.9	13.3
8	12.6	12.9	13.3
12	12.7	13.0	13.4
16	12.8	13.0	13.4
20	12.9	13.1	13.5
24	13.0	13.2	13.6
28	13.1	13.4	13.7
32	13.3	13.5	13.8
36	13.4	13.6	14.0
40	13.6	13.8	14.1
44	13.8	14.0	14.2
48	14.0	14.2	14.4
52	14.3	14.4	14.6
56	14.5	14.6	14.8
60	14.7	14.8	14.9
64	15.0	15.1	15.1
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.7
80	16.1	16.0	16.0
84	16.4	16.3	16.2
88	16.6	16.5	16.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.5 GHA	VENUS −3.5 Dec.	MARS 2.0 GHA	MARS 2.0 Dec.	JUPITER −1.8 GHA	JUPITER −1.8 Dec.	SATURN 1.0 GHA	SATURN 1.0 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
29 0	336 54.3	216 08.2	+19 56.0	194 44.2	+16 07.0	254 26.0	+22 40.7	133 54.7	− 7 06.9	307 27.7	80	+17 35.0	+124
1	351 56.7	231 07.6	55.5	209 45.1	06.5	269 28.1	40.7	148 57.0	07.0	321 54.7	79	17 47.4	+123
2	6 59.2	246 06.9	55.1	224 46.0	06.1	284 30.2	40.8	163 59.2	07.1	336 21.6	79	17 59.7	+122
3	22 01.6	261 06.3	•• 54.6	239 46.9	•• 05.6	299 32.3	•• 40.8	179 01.5	•• 07.2	350 48.5	79	•18 11.9	+121
4	37 04.1	276 05.7	54.2	254 47.7	05.1	314 34.4	40.8	194 03.7	07.2	5 15.4	78	18 24.0	+119
5	52 06.6	291 05.1	53.7	269 48.6	04.6	329 36.5	40.8	209 06.0	07.3	19 42.2	78	18 35.9	+119
6	67 09.0	306 04.4	+19 53.2	284 49.5	+16 04.1	344 38.6	+22 40.8	224 08.2	− 7 07.4	34 09.0	78	+18 47.8	+117
7	82 11.5	321 03.8	52.8	299 50.4	03.6	359 40.7	40.8	239 10.5	07.5	48 35.8	77	18 59.5	+115
8	97 14.0	336 03.2	52.3	314 51.3	03.1	14 42.8	40.9	254 12.7	07.6	63 02.5	76	19 11.0	+115
9	112 16.4	351 02.6	•• 51.9	329 52.2	•• 02.6	29 44.9	•• 40.9	269 15.0	•• 07.7	77 29.1	76	•19 22.5	+113
10	127 18.9	6 01.9	51.4	344 53.1	02.1	44 47.0	40.9	284 17.2	07.8	91 55.7	76	19 33.8	+112
11	142 21.4	21 01.3	50.9	359 54.0	01.6	59 49.1	40.9	299 19.4	07.9	106 22.3	75	19 45.0	+110
12	157 23.8	36 00.7	+19 50.5	14 54.9	+16 01.1	74 51.2	+22 40.9	314 21.7	− 7 08.0	120 48.8	75	+19 56.0	+109
13	172 26.3	51 00.1	50.0	29 55.8	00.6	89 53.3	41.0	329 23.9	08.1	135 15.3	75	20 06.9	+108
14	187 28.8	65 59.4	49.5	44 56.6	16 00.1	104 55.4	41.0	344 26.2	08.2	149 41.8	74	20 17.7	+106
15	202 31.2	80 58.8	•• 49.1	59 57.5	•15 59.6	119 57.5	•• 41.0	359 28.4	•• 08.3	164 08.2	74	•20 28.3	+105
16	217 33.7	95 58.2	48.6	74 58.4	59.1	134 59.6	41.0	14 30.7	08.4	178 34.6	73	20 38.8	+104
17	232 36.1	110 57.6	48.1	89 59.3	58.6	150 01.7	41.0	29 32.9	08.4	193 00.9	73	20 49.2	+102
18	247 38.6	125 56.9	+19 47.6	105 00.2	+15 58.1	165 03.8	+22 41.0	44 35.2	− 7 08.5	207 27.2	73	+20 59.4	+101
19	262 41.1	140 56.3	47.2	120 01.1	57.6	180 05.9	41.1	59 37.4	08.6	221 53.5	72	21 09.5	+100
20	277 43.5	155 55.7	46.7	135 02.0	57.1	195 08.0	41.1	74 39.7	08.7	236 19.7	72	21 19.5	+ 98
21	292 46.0	170 55.1	•• 46.2	150 02.9	•• 56.6	210 10.1	•• 41.1	89 41.9	•• 08.8	250 45.9	71	•21 29.3	+ 96
22	307 48.5	185 54.4	45.7	165 03.8	56.1	225 12.2	41.1	104 44.2	08.9	265 12.0	71	21 38.9	+ 96
23	322 50.9	200 53.8	45.3	180 04.7	55.6	240 14.3	41.1	119 46.4	09.0	279 38.1	71	21 48.5	+ 93
30 0	337 53.4	215 53.2	+19 44.8	195 05.6	+15 55.1	255 16.4	+22 41.1	134 48.7	− 7 09.1	294 04.2	70	+21 57.8	+ 93
1	352 55.9	230 52.6	44.3	210 06.5	54.6	270 18.5	41.2	149 50.9	09.2	308 30.2	70	22 07.1	+ 91
2	7 58.3	245 51.9	43.8	225 07.4	54.1	285 20.6	41.2	164 53.1	09.3	322 56.2	70	22 16.2	+ 89
3	23 00.8	260 51.3	•• 43.3	240 08.2	•• 53.7	300 22.7	•• 41.2	179 55.4	•• 09.4	337 22.2	69	•22 25.1	+ 88
4	38 03.3	275 50.7	42.9	255 09.1	53.2	315 24.8	41.2	194 57.6	09.5	351 48.1	69	22 33.9	+ 86
5	53 05.7	290 50.1	42.4	270 10.0	52.7	330 26.9	41.2	209 59.9	09.6	6 14.0	69	22 42.5	+ 85
6	68 08.2	305 49.4	+19 41.9	285 10.9	+15 52.2	345 29.0	+22 41.2	225 02.1	− 7 09.6	20 39.9	69	+22 51.0	+ 84
7	83 10.6	320 48.8	41.4	300 11.8	51.7	0 31.1	41.3	240 04.4	09.7	35 05.8	68	22 59.4	+ 82
8	98 13.1	335 48.2	40.9	315 12.7	51.2	15 33.2	41.3	255 06.6	09.8	49 31.6	67	23 07.6	+ 80
9	113 15.6	350 47.6	•• 40.4	330 13.6	•• 50.7	30 35.3	•• 41.3	270 08.9	•• 09.9	63 57.3	68	•23 15.6	+ 79
10	128 18.0	5 46.9	39.9	345 14.5	50.2	45 37.4	41.3	285 11.1	10.0	78 23.1	67	23 23.5	+ 77
11	143 20.5	20 46.3	39.4	0 15.4	49.7	60 39.5	41.3	300 13.4	10.1	92 48.8	67	23 31.2	+ 76
12	158 23.0	35 45.7	+19 39.0	15 16.3	+15 49.2	75 41.6	+22 41.3	315 15.6	− 7 10.2	107 14.5	67	+23 38.8	+ 74
13	173 25.4	50 45.1	38.5	30 17.2	48.7	90 43.7	41.4	330 17.8	10.3	121 40.2	67	23 46.2	+ 73
14	188 27.9	65 44.5	38.0	45 18.1	48.2	105 45.9	41.4	345 20.1	10.4	136 05.9	66	23 53.5	+ 71
15	203 30.4	80 43.8	•• 37.5	60 19.0	•• 47.7	120 48.0	•• 41.4	0 22.3	•• 10.5	150 31.5	66	•24 00.6	+ 70
16	218 32.8	95 43.2	37.0	75 19.9	47.2	135 50.1	41.4	15 24.6	10.6	164 57.1	66	24 07.6	+ 68
17	233 35.3	110 42.6	36.5	90 20.8	46.7	150 52.2	41.4	30 26.8	10.7	179 22.7	65	24 14.4	+ 67
18	248 37.8	125 42.0	+19 36.0	105 21.7	+15 46.2	165 54.3	+22 41.4	45 29.1	− 7 10.8	193 48.2	66	+24 21.1	+ 65
19	263 40.2	140 41.4	35.5	120 22.6	45.7	180 56.4	41.5	60 31.3	10.9	208 13.8	65	24 27.6	+ 63
20	278 42.7	155 40.7	35.0	135 23.4	45.2	195 58.5	41.5	75 33.6	11.0	222 39.3	65	24 33.9	+ 62
21	293 45.1	170 40.1	•• 34.5	150 24.3	•• 44.7	211 00.6	•• 41.5	90 35.8	•• 11.0	237 04.8	65	•24 40.1	+ 60
22	308 47.6	185 39.5	34.0	165 25.2	44.2	226 02.7	41.5	105 38.0	11.1	251 30.3	65	24 46.1	+ 59
23	323 50.1	200 38.9	33.5	180 26.1	43.7	241 04.8	41.5	120 40.3	11.2	265 55.8	65	24 52.0	+ 57
31 0	338 52.5	215 38.2	+19 33.0	195 27.0	+15 43.2	256 06.9	+22 41.5	135 42.5	− 7 11.3	280 21.3	64	+24 57.7	+ 55
1	353 55.0	230 37.6	32.5	210 27.9	42.7	271 09.0	41.6	150 44.8	11.4	294 46.7	65	25 03.2	+ 54
2	8 57.5	245 37.0	32.0	225 28.8	42.1	286 11.1	41.6	165 47.0	11.5	309 12.2	64	25 08.6	+ 52
3	23 59.9	260 36.4	•• 31.5	240 29.7	•• 41.6	301 13.2	•• 41.6	180 49.3	•• 11.6	323 37.6	64	•25 13.8	+ 51
4	39 02.4	275 35.8	31.0	255 30.6	41.1	316 15.4	41.6	195 51.5	11.7	338 03.0	65	25 18.9	+ 49
5	54 04.9	290 35.1	30.5	270 31.5	40.6	331 17.5	41.6	210 53.8	11.8	352 28.5	64	25 23.8	+ 48
6	69 07.3	305 34.5	+19 30.0	285 32.4	+15 40.1	346 19.6	+22 41.6	225 56.0	− 7 11.9	6 53.9	64	+25 28.6	+ 45
7	84 09.8	320 33.9	29.4	300 33.3	39.6	1 21.7	41.7	240 58.2	12.0	21 19.3	64	25 33.1	+ 45
8	99 12.2	335 33.3	28.9	315 34.2	39.1	16 23.8	41.7	256 00.5	12.1	35 44.7	64	25 37.6	+ 42
9	114 14.7	350 32.7	•• 28.4	330 35.1	•• 38.6	31 25.9	•• 41.7	271 02.7	•• 12.2	50 10.1	64	•25 41.8	+ 41
10	129 17.2	5 32.0	27.9	345 36.0	38.1	46 28.0	41.7	286 05.0	12.3	64 35.5	64	25 45.9	+ 40
11	144 19.6	20 31.4	27.4	0 36.9	37.6	61 30.1	41.7	301 07.2	12.4	79 00.9	65	25 49.9	+ 38
12	159 22.1	35 30.8	+19 26.9	15 37.8	+15 37.1	76 32.2	+22 41.7	316 09.5	− 7 12.4	93 26.4	64	+25 53.7	+ 36
13	174 24.6	50 30.2	26.4	30 38.7	36.6	91 34.4	41.8	331 11.7	12.5	107 51.8	64	25 57.3	+ 34
14	189 27.0	65 29.6	25.9	45 39.6	36.1	106 36.5	41.8	346 13.9	12.6	122 17.2	64	26 00.7	+ 33
15	204 29.5	80 29.0	•• 25.3	60 40.5	•• 35.6	121 38.6	•• 41.8	1 16.2	•• 12.7	136 42.6	65	•26 04.0	+ 32
16	219 32.0	95 28.3	24.8	75 41.4	35.1	136 40.7	41.8	16 18.4	12.8	151 08.1	64	26 07.2	+ 29
17	234 34.4	110 27.7	24.3	90 42.3	34.6	151 42.8	41.8	31 20.7	12.9	165 33.5	65	26 10.1	+ 29
18	249 36.9	125 27.1	+19 23.8	105 43.2	+15 34.1	166 44.9	+22 41.8	46 22.9	− 7 13.0	179 59.0	65	+26 13.0	+ 26
19	264 39.4	140 26.5	23.3	120 44.1	33.6	181 47.0	41.9	61 25.1	13.1	194 24.5	65	26 15.6	+ 25
20	279 41.8	155 25.9	22.7	135 45.0	33.1	196 49.1	41.9	76 27.4	13.2	208 50.0	65	26 18.1	+ 23
21	294 44.3	170 25.3	•• 22.2	150 45.9	•• 32.6	211 51.3	•• 41.9	91 29.6	•• 13.3	223 15.5	65	•26 20.4	+ 22
22	309 46.7	185 24.6	21.7	165 46.8	32.1	226 53.4	41.9	106 31.9	13.4	237 41.0	66	26 22.6	+ 20
23	324 49.2	200 24.0	21.2	180 47.7	31.6	241 55.5	41.9	121 34.1	13.5	252 06.6	66	26 24.6	+ 19
24	339 51.7	215 23.4	+19 20.7	195 48.6	+15 31.1	256 57.6	+22 41.9	136 36.4	− 7 13.6	266 32.2	65	+26 26.5	+ 17
code	−	− 6	− 5	+ 9	− 5	+ 21	+ 1	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
29 h 0	179 43.9	+ 9 33.0
1	194 44.0	32.1
2	209 44.2	31.2
3	224 44.4	•• 30.4
4	239 44.6	29.5
5	254 44.8	28.6
6	269 45.0	+ 9 27.7
7	284 45.2	26.8
8	299 45.3	25.9
9	314 45.5	•• 25.0
10	329 45.7	24.1
11	344 45.9	23.3
12	359 46.1	+ 9 22.4
13	14 46.3	21.5
14	29 46.5	20.6
15	44 46.7	•• 19.7
16	59 46.8	18.8
17	74 47.0	17.9
18	89 47.2	+ 9 17.0
19	104 47.4	16.1
20	119 47.6	15.2
21	134 47.8	•• 14.4
22	149 48.0	13.5
23	164 48.2	12.6
30 0	179 48.3	+ 9 11.7
1	194 48.5	10.8
2	209 48.7	09.9
3	224 48.9	•• 09.0
4	239 49.1	08.1
5	254 49.3	07.2
6	269 49.5	+ 9 06.3
7	284 49.7	05.4
8	299 49.9	04.5
9	314 50.0	•• 03.6
10	329 50.2	02.7
11	344 50.4	01.9
12	359 50.6	+ 9 01.0
13	14 50.8	9 00.1
14	29 51.0	8 59.2
15	44 51.2	•• 58.3
16	59 51.4	57.4
17	74 51.6	56.5
18	89 51.8	+ 8 55.6
19	104 52.0	54.7
20	119 52.1	53.8
21	134 52.3	•• 52.9
22	149 52.5	52.0
23	164 52.7	51.1
31 0	179 52.9	+ 8 50.2
1	194 53.1	49.3
2	209 53.3	48.4
3	224 53.5	•• 47.5
4	239 53.7	46.6
5	254 53.9	45.7
6	269 54.1	+ 8 44.8
7	284 54.3	43.9
8	299 54.5	43.0
9	314 54.6	•• 42.1
10	329 54.8	41.2
11	344 55.0	40.3
12	359 55.2	+ 8 39.4
13	14 55.4	38.5
14	29 55.6	37.6
15	44 55.8	•• 36.7
16	59 56.0	35.8
17	74 56.2	34.9
18	89 56.4	+ 8 34.0
19	104 56.6	33.1
20	119 56.8	32.2
21	134 57.0	•• 31.3
22	149 57.2	30.4
23	164 57.4	29.5
24	179 57.6	+ 8 28.6
code	–	– 9

STARS No.	Name	SHA	Dec.
7	Acamar	315 52.1	−40 28.9
5	Achernar	335 59.5	−57 27.9
30	Acrux	174 00.4	−62 50.8
19	Adhara	255 48.0	−28 54.2
10	Aldebaran	291 40.9	+16 25.2
32	Alioth	167 00.2	+56 12.8
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 32.0	− 1 13.6
25	Alphard	218 40.5	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.4	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.7	+19 25.4
43	Atria	109 03.4	−68 57.1
22	Avior	234 37.1	−59 21.4
13	Bellatrix	279 20.2	+ 6 18.8
16	Betelg'se	271 50.0	+ 7 24.2
17	Canopus	264 16.3	−52 39.8
12	Capella	281 40.9	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 47.0	+62 00.1
14	Elnath	279 09.4	+28 34.3
47	Eltanin	91 06.8	+51 29.8
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.6	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.2	−60 09.3
6	Hamal	328 51.3	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 18.0	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.8	+ 3 54.8
36	Menkent	149 00.8	−36 08.8
24	Miapl'dus	221 50.5	−69 31.4
9	Mirfak	309 44.6	+49 41.9
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.1	−56 53.2
21	Pollux	244 22.7	+28 08.4
20	Procyon	245 46.9	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.2	− 8 15.0
38	Rigil Kent.	140 53.6	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.5	+56 17.0
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.4	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 26.0	−43 14.5
49	Vega	81 09.1	+38 44.6
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 29	30	31
h	m s	m s	m s
0	− 1 05.0	− 0 47.0	− 0 28.7
6	− 1 00.5	− 0 42.5	− 0 24.1
12	− 0 56.0	− 0 37.9	− 0 19.5
18	− 0 51.5	− 0 33.3	− 0 14.8
24	− 0 47.0	− 0 28.7	− 0 10.1

Lat.	Sunrise	Twlt. begins	Moonrise 29	30	31	1
N °	h m	h m	h m	h m	h m	h m
72	3 50	////	▭	▭	▭	▭
70	4 05	////	▭	▭	▭	▭
68	4 18	////	17 30	▭	▭	▭
66	4 28	////	18 15	▭	▭	▭
64	4 36	////	18 45	18 36	▭	▭
62	4 43	0 56	19 08	19 15	19 34	20 25
60	4 49	1 40	19 26	19 42	20 12	21 05
58	4 55	2 07	19 42	20 03	20 39	21 33
56	5 00	2 28	19 55	20 21	21 00	21 55
54	5 04	2 43	20 06	20 36	21 17	22 13
52	5 08	2 57	20 16	20 49	21 32	22 28
50	5 11	3 09	20 26	21 00	21 45	22 41
45	5 19	3 31	20 45	21 24	22 12	23 08
40	5 25	3 48	21 01	21 43	22 33	23 29
35	5 31	4 01	21 14	21 59	22 51	23 47
30	5 36	4 12	21 26	22 13	23 06	24 02
20	5 44	4 29	21 46	22 37	23 32	24 28
10	5 51	4 40	22 04	22 58	23 54	24 51
0	5 57	4 48	22 21	23 18	24 15	0 15
10	6 04	4 54	22 37	23 37	24 36	0 36
20	6 10	4 57	22 55	23 58	24 59	0 59
30	6 18	4 59	23 16	24 23	0 23	1 25
35	6 22	4 59	23 29	24 37	0 37	1 40
40	6 27	4 58	23 43	24 54	0 54	1 58
45	6 32	4 56	24 00	0 00	1 14	2 20
50	6 39	4 53	24 21	0 21	1 39	2 47
52	6 42	4 52	24 31	0 31	1 52	3 01
54	6 45	4 50	24 42	0 42	2 06	3 16
56	6 49	4 48	24 55	0 55	2 22	3 35
58	6 53	4 45	25 11	1 11	2 42	3 57
60	6 58	4 42	25 29	1 29	3 07	4 26
S						

Lat.	Sunset	Twlt. ends	Moonset 29	30	31	1
N °	h m	h m	h m	h m	h m	h m
72	20 08	////	▭	▭	▭	▭
70	19 53	////	▭	▭	▭	▭
68	19 41	////	14 25	▭	▭	▭
66	19 32	////	13 41	▭	▭	▭
64	19 23	////	13 12	15 20	▭	▭
62	19 16	22 54	12 50	14 42	16 23	17 31
60	19 10	22 14	12 33	14 15	15 45	16 50
58	19 05	21 49	12 18	13 54	15 18	16 22
56	19 00	21 29	12 06	13 37	14 58	16 00
54	18 56	21 14	11 55	13 23	14 40	15 43
52	18 52	21 00	11 45	13 10	14 25	15 27
50	18 49	20 50	11 37	12 59	14 13	15 14
45	18 41	20 27	11 19	12 36	13 46	14 47
40	18 35	20 11	11 04	12 17	13 25	14 25
35	18 30	19 58	10 52	12 02	13 08	14 07
30	18 25	19 48	10 41	11 48	12 53	13 52
20	18 17	19 32	10 22	11 26	12 27	13 26
10	18 10	19 21	10 06	11 06	12 06	13 03
0	18 04	19 14	9 51	10 48	11 45	12 42
10	17 58	19 08	9 36	10 29	11 25	12 21
20	17 51	19 04	9 21	10 10	11 03	11 59
30	17 44	19 04	9 02	9 47	10 38	11 32
35	17 40	19 04	8 52	9 34	10 23	11 17
40	17 35	19 05	8 40	9 19	10 05	10 59
45	17 29	19 07	8 26	9 01	9 45	10 37
50	17 23	19 11	8 09	8 39	9 19	10 09
52	17 20	19 12	8 01	8 29	9 06	9 56
54	17 17	19 15	7 52	8 17	8 52	9 40
56	17 13	19 17	7 42	8 03	8 35	9 22
58	17 09	19 20	7 31	7 48	8 15	9 00
60	17 05	19 24	7 18	7 29	7 50	8 31
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
29	3 38	9 36	11 00	7 01	15 02
30	4 34	9 37	10 59	6 58	14 59
31	5 31	9 38	10 58	6 55	14 55
1	6 29	9 39	10 56	6 51	14 51

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	29	30	31
°	′	′	′
0	18.6	17.6	16.4
4	18.6	17.6	16.4
8	18.6	17.6	16.4
12	18.5	17.5	16.4
16	18.5	17.5	16.4
20	18.4	17.5	16.4
24	18.4	17.4	16.4
28	18.3	17.4	16.3
32	18.2	17.3	16.3
36	18.1	17.2	16.3
40	18.0	17.2	16.3
44	17.9	17.1	16.2
48	17.7	17.0	16.2
52	17.6	16.9	16.2
56	17.5	16.8	16.1
60	17.3	16.7	16.1
64	17.2	16.6	16.0
68	17.0	16.5	16.0
72	16.9	16.4	15.9
76	16.7	16.3	15.9
80	16.5	16.2	15.8
84	16.4	16.1	15.8
88	16.2	16.0	15.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	29	30	31
°	′	′	′
0	13.8	14.4	15.0
4	13.8	14.4	15.0
8	13.8	14.4	15.1
12	13.9	14.4	15.1
16	13.9	14.5	15.1
20	14.0	14.5	15.1
24	14.0	14.5	15.1
28	14.1	14.6	15.1
32	14.2	14.7	15.2
36	14.3	14.7	15.2
40	14.4	14.8	15.2
44	14.5	14.9	15.3
48	14.7	15.0	15.3
52	14.8	15.0	15.3
56	14.9	15.1	15.4
60	15.1	15.2	15.4
64	15.2	15.3	15.5
68	15.4	15.4	15.5
72	15.5	15.5	15.5
76	15.7	15.7	15.6
80	15.9	15.8	15.6
84	16.0	15.9	15.7
88	16.2	16.0	15.7
90			

Subtract from table, back cover

Last Quarter 31

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
1 0	339 51.7	215 23.4	+19 20.7	195 48.6	+15 31.1	256 57.6	+22 41.9	136 36.4	− 7 13.6	266 32.2	65	+26 26.5	+ 17
1	354 54.1	230 22.8	20.1	210 49.5	30.6	271 59.7	42.0	151 38.6	13.7	280 57.7	67	26 28.2	+ 15
2	9 56.6	245 22.2	19.6	225 50.4	30.1	287 01.8	42.0	166 40.8	13.8	295 23.4	66	26 29.7	+ 14
3	24 59.1	260 21.6	·· 19.1	240 51.3	·· 29.5	302 03.9	·· 42.0	181 43.1	·· 13.9	309 49.0	67	·26 31.1	+ 12
4	40 01.5	275 20.9	18.5	255 52.2	29.0	317 06.1	42.0	196 45.3	14.0	324 14.7	67	26 32.3	+ 10
5	55 04.0	290 20.3	18.0	270 53.1	28.5	332 08.2	42.0	211 47.6	14.1	338 40.4	67	26 33.3	+ 9
6	70 06.5	305 19.7	+19 17.5	285 54.0	+15 28.0	347 10.3	+22 42.0	226 49.8	− 7 14.1	353 06.1	68	+26 34.2	+ 8
7	85 08.9	320 19.1	16.9	300 54.9	27.5	2 12.4	42.0	241 52.0	14.2	7 31.9	68	26 35.0	+ 6
8	100 11.4	335 18.5	16.4	315 55.8	27.0	17 14.5	42.1	256 54.3	14.3	21 57.7	68	26 35.6	+ 4
9	115 13.9	350 17.9	·· 15.9	330 56.7	·· 26.5	32 16.6	·· 42.1	271 56.5	·· 14.4	36 23.5	69	·26 36.0	+ 2
10	130 16.3	5 17.2	15.3	345 57.6	26.0	47 18.8	42.1	286 58.8	14.5	50 49.4	69	26 36.2	+ 2
11	145 18.8	20 16.6	14.8	0 58.5	25.5	62 20.9	42.1	302 01.0	14.6	65 15.3	69	26 36.4	− 1
12	160 21.2	35 16.0	+19 14.3	15 59.4	+15 25.0	77 23.0	+22 42.1	317 03.3	− 7 14.7	79 41.2	70	+26 36.3	− 2
13	175 23.7	50 15.4	13.7	31 00.3	24.5	92 25.1	42.1	332 05.5	14.8	94 07.2	70	26 36.1	− 3
14	190 26.2	65 14.8	13.2	46 01.2	24.0	107 27.2	42.2	347 07.7	14.9	108 33.2	71	26 35.8	− 5
15	205 28.6	80 14.2	·· 12.7	61 02.1	·· 23.5	122 29.3	·· 42.2	2 10.0	·· 15.0	122 59.3	71	·26 35.3	− 7
16	220 31.1	95 13.6	12.1	76 03.0	23.0	137 31.5	42.2	17 12.2	15.1	137 25.4	71	26 34.6	− 8
17	235 33.6	110 12.9	11.6	91 03.9	22.4	152 33.6	42.2	32 14.5	15.2	151 51.5	72	26 33.8	− 10
18	250 36.0	125 12.3	+19 11.0	106 04.8	+15 21.9	167 35.7	+22 42.2	47 16.7	− 7 15.3	166 17.7	73	+26 32.8	− 11
19	265 38.5	140 11.7	10.5	121 05.7	21.4	182 37.8	42.2	62 18.9	15.4	180 44.0	73	26 31.7	− 13
20	280 41.0	155 11.1	10.0	136 06.6	20.9	197 39.9	42.3	77 21.2	15.5	195 10.3	73	26 30.4	− 14
21	295 43.4	170 10.5	·· 09.4	151 07.5	·· 20.4	212 42.1	·· 42.3	92 23.4	·· 15.6	209 36.6	74	·26 29.0	− 15
22	310 45.9	185 09.9	08.9	166 08.4	19.9	227 44.2	42.3	107 25.6	15.7	224 03.0	75	26 27.5	− 18
23	325 48.4	200 09.3	08.3	181 09.3	19.4	242 46.3	42.3	122 27.9	15.8	238 29.5	75	26 25.7	− 18
2 0	340 50.8	215 08.6	+19 07.8	196 10.2	+15 18.9	257 48.4	+22 42.3	137 30.1	− 7 15.8	252 56.0	75	+26 23.9	− 20
2 1	355 53.3	230 08.0	07.2	211 11.1	18.4	272 50.5	42.3	152 32.4	15.9	267 22.5	77	26 21.9	− 22
2	10 55.7	245 07.4	06.7	226 12.0	17.9	287 52.7	42.3	167 34.6	16.0	281 49.2	76	26 19.7	− 23
3	25 58.2	260 06.8	·· 06.1	241 12.9	·· 17.4	302 54.8	·· 42.4	182 36.8	·· 16.1	296 15.8	78	·26 17.4	− 24
4	41 00.7	275 06.2	05.6	256 13.8	16.8	317 56.9	42.4	197 39.1	16.2	310 42.6	78	26 15.0	− 26
5	56 03.1	290 05.6	05.0	271 14.7	16.3	332 59.0	42.4	212 41.3	16.3	325 09.4	78	26 12.4	− 28
6	71 05.6	305 05.0	+19 04.5	286 15.7	+15 15.8	348 01.2	+22 42.4	227 43.6	− 7 16.4	339 36.2	80	+26 09.6	− 29
7	86 08.1	320 04.4	03.9	301 16.6	15.3	3 03.3	42.4	242 45.8	16.5	354 03.2	79	26 06.7	− 30
8	101 10.5	335 03.8	03.3	316 17.5	14.8	18 05.4	42.4	257 48.0	16.6	8 30.1	81	26 03.7	− 31
9	116 13.0	350 03.1	·· 02.8	331 18.4	·· 14.3	33 07.5	·· 42.4	272 50.3	·· 16.7	22 57.2	81	·26 00.6	− 34
10	131 15.5	5 02.5	02.2	346 19.3	13.8	48 09.6	42.5	287 52.5	16.8	37 24.3	82	25 57.2	− 34
11	146 17.9	20 01.9	01.7	1 20.2	13.3	63 11.8	42.5	302 54.8	16.9	51 51.5	82	25 53.8	− 36
12	161 20.4	35 01.3	+19 01.1	16 21.1	+15 12.8	78 13.9	+22 42.5	317 57.0	− 7 17.0	66 18.7	84	+25 50.2	− 37
13	176 22.8	50 00.7	00.6	31 22.0	12.2	93 16.0	42.5	332 59.2	17.1	80 46.1	83	25 46.5	− 39
14	191 25.3	65 00.1	19 00.0	46 22.9	11.7	108 18.1	42.5	348 01.5	17.2	95 13.4	85	25 42.6	− 40
15	206 27.8	79 59.5	·18 59.4	61 23.8	·· 11.2	123 20.3	·· 42.5	3 03.7	·· 17.3	109 40.9	85	·25 38.6	− 41
16	221 30.2	94 58.9	58.9	76 24.7	10.7	138 22.4	42.6	18 05.9	17.4	124 08.4	86	25 34.5	− 42
17	236 32.7	109 58.3	58.3	91 25.6	10.2	153 24.5	42.6	33 08.2	17.5	138 36.0	87	25 30.3	− 44
18	251 35.2	124 57.6	+18 57.7	106 26.5	+15 09.7	168 26.6	+22 42.6	48 10.4	− 7 17.6	153 03.7	87	+25 25.9	− 46
19	266 37.6	139 57.0	57.2	121 27.4	09.2	183 28.8	42.6	63 12.7	17.7	167 31.4	89	25 21.3	− 46
20	281 40.1	154 56.4	56.6	136 28.3	08.7	198 30.9	42.6	78 14.9	17.7	181 59.3	89	25 16.7	− 48
21	296 42.6	169 55.8	·· 56.0	151 29.2	·· 08.1	213 33.0	·· 42.6	93 17.1	·· 17.8	196 27.2	89	·25 11.9	− 49
22	311 45.0	184 55.2	55.5	166 30.1	07.6	228 35.2	42.6	108 19.4	17.9	210 55.1	91	25 07.0	− 51
23	326 47.5	199 54.6	54.9	181 31.0	07.1	243 37.3	42.7	123 21.6	18.0	225 23.2	91	25 01.9	− 52
3 0	341 50.0	214 54.0	+18 54.3	196 32.0	+15 06.6	258 39.4	+22 42.7	138 23.8	− 7 18.1	239 51.3	92	+24 56.7	− 53
3 1	356 52.4	229 53.4	53.8	211 32.9	06.1	273 41.5	42.7	153 26.1	18.2	254 19.5	93	24 51.4	− 54
2	11 54.9	244 52.8	53.2	226 33.8	05.6	288 43.7	42.7	168 28.3	18.3	268 47.8	93	24 46.0	− 55
3	26 57.3	259 52.2	·· 52.6	241 34.7	·· 05.1	303 45.8	·· 42.7	183 30.6	·· 18.4	283 16.1	95	·24 40.5	− 57
4	41 59.8	274 51.6	52.0	256 35.6	04.5	318 47.9	42.7	198 32.8	18.5	297 44.6	95	24 34.8	− 58
5	57 02.3	289 51.0	51.5	271 36.5	04.0	333 50.0	42.7	213 35.0	18.6	312 13.1	96	24 29.0	− 59
6	72 04.7	304 50.3	+18 50.9	286 37.4	+15 03.5	348 52.2	+22 42.8	228 37.3	− 7 18.7	326 41.7	96	+24 23.1	− 61
7	87 07.2	319 49.7	50.3	301 38.3	03.0	3 54.3	42.8	243 39.5	18.8	341 10.3	98	24 17.0	− 61
8	102 09.7	334 49.1	49.7	316 39.2	02.5	18 56.4	42.8	258 41.7	18.9	355 39.1	98	24 10.9	− 63
9	117 12.1	349 48.5	·· 49.2	331 40.1	·· 02.0	33 58.6	·· 42.8	273 44.0	·· 19.0	10 07.9	100	·24 04.6	− 64
10	132 14.6	4 47.9	48.6	346 41.0	01.5	49 00.7	42.8	288 46.2	19.1	24 36.9	100	23 58.2	− 65
11	147 17.1	19 47.3	48.0	1 41.9	00.9	64 02.8	42.8	303 48.4	19.2	39 05.9	100	23 51.7	− 66
12	162 19.5	34 46.7	+18 47.4	16 42.8	+15 00.4	79 05.0	+22 42.8	318 50.7	− 7 19.3	53 34.9	102	+23 45.1	− 68
13	177 22.0	49 46.1	46.8	31 43.8	14 59.9	94 07.1	42.9	333 52.9	19.4	68 04.1	103	23 38.3	− 68
14	192 24.5	64 45.5	46.3	46 44.7	59.4	109 09.2	42.9	348 55.2	19.5	82 33.4	103	23 31.5	− 70
15	207 26.9	79 44.9	·· 45.7	61 45.6	·· 58.9	124 11.3	·· 42.9	3 57.4	·· 19.6	97 02.7	104	·23 24.5	− 70
16	222 29.4	94 44.3	45.1	76 46.5	58.4	139 13.5	42.9	18 59.6	19.7	111 32.1	105	23 17.5	− 72
17	237 31.8	109 43.7	44.5	91 47.4	57.9	154 15.6	42.9	34 01.9	19.8	126 01.6	106	23 10.3	− 73
18	252 34.3	124 43.1	+18 43.9	106 48.3	+14 57.3	169 17.7	+22 42.9	49 04.1	− 7 19.9	140 31.2	106	+23 03.0	− 74
19	267 36.8	139 42.5	43.3	121 49.2	56.8	184 19.9	42.9	64 06.3	19.9	155 00.8	108	22 55.6	− 75
20	282 39.2	154 41.9	42.7	136 50.1	56.3	199 22.0	43.0	79 08.6	20.0	169 30.6	108	22 48.1	− 76
21	297 41.7	169 41.3	·· 42.1	151 51.0	·· 55.8	214 24.1	·· 43.0	94 10.8	·· 20.1	184 00.4	109	·22 40.5	− 77
22	312 44.2	184 40.7	41.6	166 51.9	55.3	229 26.3	43.0	109 13.0	20.2	198 30.3	110	22 32.8	− 79
23	327 46.6	199 40.1	41.0	181 52.9	54.8	244 28.4	43.0	124 15.3	20.3	213 00.3	111	22 24.9	− 79
24	342 49.1	214 39.5	+18 40.4	196 53.8	+14 54.2	259 30.5	+22 43.0	139 17.5	− 7 20.4	227 30.4	112	+22 17.0	− 80
code	—	− 6	− 5	+ 9	− 6	+ 21	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
1 0	179 57.6	+ 8 28.6
1	194 57.8	27.7
2	209 58.0	26.8
3	224 58.2	25.9
4	239 58.3	24.9
5	254 58.5	24.0
6	269 58.7	+ 8 23.1
7	284 58.9	22.2
8	299 59.1	21.3
9	314 59.3	20.4
10	329 59.5	19.5
11	344 59.7	18.6
12	359 59.9	+ 8 17.7
13	15 00.1	16.8
14	30 00.3	15.9
15	45 00.5	15.0
16	60 00.7	14.1
17	75 00.9	13.2
18	90 01.1	+ 8 12.3
19	105 01.3	11.3
20	120 01.5	10.4
21	135 01.7	09.5
22	150 01.9	08.6
23	165 02.1	07.7
2 0	180 02.3	+ 8 06.8
1	195 02.5	05.9
2	210 02.7	05.0
3	225 02.9	04.1
4	240 03.1	03.2
5	255 03.3	02.2
6	270 03.5	+ 8 01.3
7	285 03.7	8 00.4
8	300 03.9	7 59.5
9	315 04.1	58.6
10	330 04.3	57.7
11	345 04.5	56.8
12	0 04.7	+ 7 55.9
13	15 04.9	55.0
14	30 05.1	54.0
15	45 05.3	53.1
16	60 05.5	52.2
17	75 05.7	51.3
18	90 05.9	+ 7 50.4
19	105 06.1	49.5
20	120 06.3	48.6
21	135 06.5	47.6
22	150 06.7	46.7
23	165 06.9	45.8
3 0	180 07.1	+ 7 44.9
1	195 07.3	44.0
2	210 07.5	43.1
3	225 07.7	42.2
4	240 07.9	41.2
5	255 08.1	40.3
6	270 08.3	+ 7 39.4
7	285 08.5	38.5
8	300 08.7	37.6
9	315 08.9	36.7
10	330 09.1	35.7
11	345 09.3	34.8
12	0 09.5	+ 7 33.9
13	15 09.7	33.0
14	30 09.9	32.1
15	45 10.1	31.1
16	60 10.3	30.2
17	75 10.5	29.3
18	90 10.7	+ 7 28.4
19	105 10.9	27.5
20	120 11.1	26.6
21	135 11.3	25.6
22	150 11.5	24.7
23	165 11.7	23.8
24	180 11.9	+ 7 22.9
code	—	- 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 52.1	−40 29.0
5	Achernar	335 59.4	−57 27.9
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 48.0	−28 54.2
10	Aldebaran	291 40.9	+16 25.2
32	Alioth	167 00.2	+56 12.8
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.9	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.2
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.3	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.5	−68 57.1
22	Avior	234 37.1	−59 21.4
13	Bellatrix	279 20.2	+ 6 18.8
16	Betelg'se	271 49.9	+ 7 24.2
17	Canopus	264 16.3	−52 39.8
12	Capella	281 40.8	+45 57.2
53	Deneb	50 01.7	+45 07.0
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 47.0	+62 00.1
14	Elnath	279 09.4	+28 34.3
47	Eltanin	91 06.8	+51 29.8
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.2	−60 09.3
6	Hamal	328 51.2	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 18.0	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.8	+ 3 54.8
36	Menkent	149 00.8	−36 08.8
24	Miapl'dus	221 50.5	−69 31.4
9	Mirfak	309 44.5	+49 41.9
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.2
21	Pollux	244 22.7	+28 08.4
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.2	− 8 14.9
38	Rigil Kent.	140 53.6	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.4	+56 17.1
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.4	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 26.0	−43 14.5
49	Vega	81 09.1	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 1	2	3
h	m s	m s	m s
0	− 0 10.1	+ 0 08.8	+ 0 27.9
6	− 0 05.4	+ 0 13.5	+ 0 32.7
12	− 0 00.7	+ 0 18.3	+ 0 37.6
18	+ 0 04.0	+ 0 23.1	+ 0 42.4
24	+ 0 08.8	+ 0 27.9	+ 0 47.3

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 1 h m	2 h m	3 h m	4 h m
72	4 05	////	▭	▭	▭	▭
70	4 18	////	▭	▭	▭	23 00
68	4 29	////	▭	▭	▭	23 50
66	4 37	////	▭	▭	22 15	24 22
64	4 45	////	▭	20 59	22 59	24 45
62	4 51	1 23	20 25	21 51	23 28	25 04
60	4 57	1 56	21 05	22 22	23 50	25 19
58	5 01	2 19	21 33	22 46	24 08	0 08
56	5 06	2 38	21 55	23 05	24 23	0 23
54	5 09	2 53	22 13	23 21	24 35	0 35
52	5 13	3 04	22 28	23 34	24 47	0 47
50	5 16	3 15	22 41	23 46	24 57	0 57
45	5 23	3 37	23 08	24 11	0 11	1 17
40	5 28	3 52	23 29	24 31	0 31	1 34
35	5 33	4 04	23 47	24 47	0 47	1 48
30	5 37	4 15	24 02	0 02	1 01	2 01
20	5 45	4 29	24 28	0 28	1 25	2 21
10	5 51	4 40	24 51	0 51	1 46	2 39
0	5 56	4 48	0 15	1 11	2 06	2 56
10	6 02	4 52	0 36	1 32	2 25	3 13
20	6 08	4 56	0 59	1 55	2 46	3 31
30	6 15	4 55	1 25	2 21	3 09	3 51
35	6 18	4 55	1 40	2 36	3 23	4 03
40	6 23	4 54	1 58	2 53	3 39	4 17
45	6 27	4 51	2 20	3 15	3 59	4 33
50	6 33	4 47	2 47	3 42	4 23	4 53
52	6 36	4 45	3 01	3 55	4 34	5 03
54	6 39	4 42	3 16	4 10	4 47	5 13
56	6 42	4 40	3 35	4 27	5 02	5 25
58	6 45	4 36	3 57	4 49	5 20	5 39
60	6 49	4 33	4 26	5 16	5 41	5 55
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 1 h m	2 h m	3 h m	4 h m
72	19 51	////	▭	▭	▭	▭
70	19 39	////	▭	▭	▭	20 20
68	19 28	////	▭	▭	▭	19 28
66	19 20	////	▭	▭	19 23	18 56
64	19 13	23 26	▭	18 51	18 39	18 31
62	19 07	22 28	17 31	17 59	18 09	18 12
60	19 01	21 56	16 50	17 27	17 46	17 57
58	18 57	21 35	16 22	17 03	17 28	17 43
56	18 53	21 18	16 00	16 44	17 13	17 31
54	18 49	21 03	15 43	16 28	16 59	17 21
52	18 46	20 52	15 27	16 14	16 48	17 12
50	18 42	20 41	15 14	16 02	16 37	17 04
45	18 36	20 21	14 47	15 36	16 16	16 46
40	18 30	20 05	14 25	15 16	15 58	16 32
35	18 26	19 54	14 07	14 59	15 43	16 20
30	18 22	19 44	13 52	14 45	15 30	16 09
20	18 15	19 30	13 26	14 20	15 08	15 51
10	18 09	19 20	13 03	13 58	14 49	15 35
0	18 03	19 12	12 42	13 38	14 30	15 19
10	17 58	19 08	12 21	13 18	14 12	15 04
20	17 52	19 05	11 59	12 56	13 53	14 48
30	17 45	19 05	11 32	12 30	13 30	14 29
35	17 42	19 06	11 17	12 15	13 16	14 18
40	17 38	19 08	10 59	11 58	13 01	14 05
45	17 33	19 11	10 37	11 37	12 42	13 49
50	17 27	19 15	10 09	11 11	12 19	13 31
52	17 25	19 17	9 56	10 58	12 08	13 22
54	17 22	19 20	9 40	10 43	11 55	13 12
56	17 19	19 23	9 22	10 25	11 41	13 00
58	17 15	19 26	9 00	10 04	11 23	12 47
60	17 11	19 30	8 31	9 37	11 02	12 32
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
1	6 29	9 39	10 56	6 51	14 51
2	7 25	9 40	10 55	6 48	14 48
3	8 18	9 41	10 53	6 44	14 44
4	9 08	9 42	10 52	6 41	14 41

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	1	2	3
°	′	′	′
0	15.4	14.5	13.8
4	15.4	14.5	13.8
8	15.4	14.5	13.8
12	15.4	14.6	13.8
16	15.4	14.6	13.8
20	15.4	14.6	13.9
24	15.4	14.6	13.9
28	15.4	14.6	14.0
32	15.4	14.7	14.0
36	15.4	14.7	14.1
40	15.4	14.7	14.1
44	15.5	14.8	14.2
48	15.5	14.8	14.3
52	15.5	14.9	14.3
56	15.5	14.9	14.4
60	15.5	15.0	14.5
64	15.5	15.0	14.6
68	15.5	15.1	14.7
72	15.5	15.1	14.8
76	15.5	15.2	14.9
80	15.5	15.2	15.0
84	15.5	15.3	15.1
88	15.5	15.3	15.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	1	2	3
°	′	′	′
0	15.6	16.1	16.6
4	15.6	16.1	16.6
8	15.6	16.1	16.5
12	15.6	16.1	16.5
16	15.6	16.1	16.5
20	15.6	16.1	16.5
24	15.6	16.1	16.4
28	15.6	16.0	16.4
32	15.6	16.0	16.3
36	15.6	16.0	16.3
40	15.6	15.9	16.2
44	15.6	15.9	16.1
48	15.6	15.8	16.1
52	15.6	15.8	16.0
56	15.6	15.8	15.9
60	15.6	15.7	15.8
64	15.6	15.7	15.7
68	15.6	15.6	15.6
72	15.6	15.6	15.6
76	15.5	15.5	15.5
80	15.5	15.4	15.4
84	15.5	15.4	15.3
88	15.5	15.3	15.2
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.8 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
4 0	342 49.1	214 39.5	+18 40.4	196 53.8	+14 54.2	259 30.5	+22 43.0	139 17.5	− 7 20.4	227 30.4	112	+22 17.0	− 80
1	357 51.6	229 38.9	39.8	211 54.7	53.7	274 32.7	43.0	154 19.7	20.5	242 00.6	112	22 09.0	− 81
2	12 54.0	244 38.2	39.2	226 55.6	53.2	289 34.8	43.0	169 22.0	20.6	256 30.8	113	22 00.9	− 82
3	27 56.5	259 37.6	•• 38.6	241 56.5	•• 52.7	304 36.9	•• 43.1	184 24.2	•• 20.7	271 01.1	115	•21 52.7	− 84
4	42 59.0	274 37.0	38.0	256 57.4	52.2	319 39.1	43.1	199 26.4	20.8	285 31.6	115	21 44.3	− 84
5	58 01.4	289 36.4	37.4	271 58.3	51.6	334 41.2	43.1	214 28.7	20.9	300 02.1	115	21 35.9	− 85
6	73 03.9	304 35.8	+18 36.8	286 59.2	+14 51.1	349 43.3	+22 43.1	229 30.9	− 7 21.0	314 32.6	117	+21 27.4	− 86
7	88 06.3	319 35.2	36.2	302 00.1	50.6	4 45.5	43.1	244 33.1	21.1	329 03.3	117	21 18.8	− 87
8	103 08.8	334 34.6	35.6	317 01.1	50.1	19 47.6	43.1	259 35.4	21.2	343 34.0	119	21 10.1	− 88
9	118 11.3	349 34.0	•• 35.0	332 02.0	•• 49.6	34 49.8	•• 43.1	274 37.6	•• 21.3	358 04.9	119	•21 01.3	− 89
10	133 13.7	4 33.4	34.4	347 02.9	49.1	49 51.9	43.2	289 39.9	21.4	12 35.8	120	20 52.4	− 89
11	148 16.2	19 32.8	33.8	2 03.8	48.5	64 54.0	43.2	304 42.1	21.5	27 06.8	120	20 43.5	− 91
12	163 18.7	34 32.2	+18 33.2	17 04.7	+14 48.0	79 56.2	+22 43.2	319 44.3	− 7 21.6	41 37.8	122	+20 34.4	− 92
13	178 21.1	49 31.6	32.6	32 05.6	47.5	94 58.3	43.2	334 46.6	21.7	56 09.0	122	20 25.2	− 92
14	193 23.6	64 31.0	32.0	47 06.5	47.0	110 00.4	43.2	349 48.8	21.8	70 40.2	124	20 16.0	− 93
15	208 26.1	79 30.4	•• 31.4	62 07.4	•• 46.5	125 02.6	•• 43.2	4 51.0	•• 21.9	85 11.6	124	•20 06.7	− 94
16	223 28.5	94 29.8	30.8	77 08.3	45.9	140 04.7	43.2	19 53.3	22.0	99 43.0	124	19 57.3	− 95
17	238 31.0	109 29.2	30.2	92 09.3	45.4	155 06.8	43.3	34 55.5	22.1	114 14.4	126	19 47.8	− 96
18	253 33.4	124 28.6	+18 29.5	107 10.2	+14 44.9	170 09.0	+22 43.3	49 57.7	− 7 22.2	128 46.0	126	+19 38.2	− 97
19	268 35.9	139 28.0	28.9	122 11.1	44.4	185 11.1	43.3	65 00.0	22.3	143 17.6	128	19 28.5	− 97
20	283 38.4	154 27.4	28.3	137 12.0	43.9	200 13.3	43.3	80 02.2	22.4	157 49.4	127	19 18.8	− 98
21	298 40.8	169 26.8	•• 27.7	152 12.9	•• 43.3	215 15.4	•• 43.3	95 04.4	•• 22.5	172 21.1	129	•19 09.0	− 99
22	313 43.3	184 26.2	27.1	167 13.8	42.8	230 17.5	43.3	110 06.7	22.6	186 53.0	130	18 59.1	−100
23	328 45.8	199 25.6	26.5	182 14.7	42.3	245 19.7	43.3	125 08.9	22.6	201 25.0	130	18 49.1	−100
5 0	343 48.2	214 25.0	+18 25.9	197 15.7	+14 41.8	260 21.8	+22 43.4	140 11.1	− 7 22.7	215 57.0	131	+18 39.1	−102
1	358 50.7	229 24.4	25.3	212 16.6	41.3	275 24.0	43.4	155 13.3	22.8	230 29.1	132	18 28.9	−102
2	13 53.2	244 23.8	24.6	227 17.5	40.7	290 26.1	43.4	170 15.6	22.9	245 01.3	132	18 18.7	−103
3	28 55.6	259 23.2	•• 24.0	242 18.4	•• 40.2	305 28.2	•• 43.4	185 17.8	•• 23.0	259 33.5	134	•18 08.4	−103
4	43 58.1	274 22.6	23.4	257 19.3	39.7	320 30.4	43.4	200 20.0	23.1	274 05.9	134	17 58.1	−104
5	59 00.6	289 22.0	22.8	272 20.2	39.2	335 32.5	43.4	215 22.3	23.2	288 38.3	135	17 47.7	−105
6	74 03.0	304 21.4	+18 22.2	287 21.1	+14 38.6	350 34.7	+22 43.4	230 24.5	− 7 23.3	303 10.8	135	+17 37.2	−106
7	89 05.5	319 20.9	21.5	302 22.1	38.1	5 36.8	43.4	245 26.7	23.4	317 43.3	137	17 26.6	−106
8	104 07.9	334 20.3	20.9	317 23.0	37.6	20 39.0	43.5	260 29.0	23.5	332 16.0	137	17 16.0	−107
9	119 10.4	349 19.7	•• 20.3	332 23.9	•• 37.1	35 41.1	•• 43.5	275 31.2	•• 23.6	346 48.7	137	•17 05.3	−108
10	134 12.9	4 19.1	19.7	347 24.8	36.6	50 43.2	43.5	290 33.4	23.7	1 21.4	139	16 54.5	−108
11	149 15.3	19 18.5	19.1	2 25.7	36.0	65 45.4	43.5	305 35.7	23.8	15 54.3	139	16 43.7	−109
12	164 17.8	34 17.9	+18 18.4	17 26.6	+14 35.5	80 47.5	+22 43.5	320 37.9	− 7 23.9	30 27.2	140	+16 32.8	−109
13	179 20.3	49 17.3	17.8	32 27.5	35.0	95 49.7	43.5	335 40.1	24.0	45 00.2	140	16 21.9	−111
14	194 22.7	64 16.7	17.2	47 28.5	34.5	110 51.8	43.5	350 42.4	24.1	59 33.2	141	16 10.8	−111
15	209 25.2	79 16.1	•• 16.5	62 29.4	•• 33.9	125 54.0	•• 43.6	5 44.6	•• 24.2	74 06.3	142	•15 59.7	−111
16	224 27.7	94 15.5	15.9	77 30.3	33.4	140 56.1	43.6	20 46.8	24.3	88 39.5	143	15 48.6	−112
17	239 30.1	109 14.9	15.3	92 31.2	32.9	155 58.2	43.6	35 49.1	24.4	103 12.8	143	15 37.4	−113
18	254 32.6	124 14.3	+18 14.7	107 32.1	+14 32.4	171 00.4	+22 43.6	50 51.3	− 7 24.5	117 46.1	144	+15 26.1	−113
19	269 35.0	139 13.7	14.0	122 33.0	31.9	186 02.5	43.6	65 53.5	24.6	132 19.5	145	15 14.8	−114
20	284 37.5	154 13.1	13.4	137 34.0	31.3	201 04.7	43.6	80 55.8	24.7	146 53.0	145	15 03.4	−114
21	299 40.0	169 12.5	•• 12.8	152 34.9	•• 30.8	216 06.8	•• 43.6	95 58.0	•• 24.8	161 26.5	146	•14 52.0	−115
22	314 42.4	184 11.9	12.1	167 35.8	30.3	231 09.0	43.6	111 00.2	24.9	176 00.1	146	14 40.5	−115
23	329 44.9	199 11.3	11.5	182 36.7	29.8	246 11.1	43.7	126 02.4	25.0	190 33.7	147	14 29.0	−116
6 0	344 47.4	214 10.7	+18 10.8	197 37.6	+14 29.2	261 13.3	+22 43.7	141 04.7	− 7 25.1	205 07.4	148	+14 17.4	−117
1	359 49.8	229 10.1	10.2	212 38.5	28.7	276 15.4	43.7	156 06.9	25.2	219 41.2	148	14 05.7	−117
2	14 52.3	244 09.5	09.6	227 39.5	28.2	291 17.6	43.7	171 09.1	25.3	234 15.0	149	13 54.0	−117
3	29 54.8	259 09.0	•• 08.9	242 40.4	•• 27.7	306 19.7	•• 43.7	186 11.4	•• 25.4	248 48.9	150	•13 42.3	−118
4	44 57.2	274 08.4	08.3	257 41.3	27.1	321 21.9	43.7	201 13.6	25.5	263 22.9	150	13 30.5	−118
5	59 59.7	289 07.8	07.7	272 42.2	26.6	336 24.0	43.7	216 15.8	25.6	277 56.9	150	13 18.7	−119
6	75 02.2	304 07.2	+18 07.0	287 43.1	+14 26.1	351 26.2	+22 43.8	231 18.1	− 7 25.7	292 30.9	152	+13 06.8	−120
7	90 04.6	319 06.6	06.4	302 44.1	25.6	6 28.3	43.8	246 20.3	25.8	307 05.1	153	12 54.8	−120
8	105 07.1	334 06.0	05.7	317 45.0	25.0	21 30.5	43.8	261 22.5	25.9	321 39.2	153	12 42.8	−120
9	120 09.5	349 05.4	•• 05.1	332 45.9	•• 24.5	36 32.6	•• 43.8	276 24.7	•• 26.0	336 13.5	153	•12 30.8	−121
10	135 12.0	4 04.8	04.4	347 46.8	24.0	51 34.8	43.8	291 27.0	26.0	350 47.8	153	12 18.7	−121
11	150 14.5	19 04.2	03.8	2 47.7	23.5	66 36.9	43.8	306 29.2	26.1	5 22.1	154	12 06.6	−122
12	165 16.9	34 03.6	+18 03.1	17 48.6	+14 22.9	81 39.1	+22 43.8	321 31.4	− 7 26.2	19 56.5	154	+11 54.4	−122
13	180 19.4	49 03.0	02.5	32 49.6	22.4	96 41.2	43.8	336 33.7	26.3	34 30.9	155	11 42.2	−122
14	195 21.9	64 02.5	01.8	47 50.5	21.9	111 43.4	43.9	351 35.9	26.4	49 05.4	156	11 30.0	−123
15	210 24.3	79 01.9	•• 01.2	62 51.4	•• 21.3	126 45.5	•• 43.9	6 38.1	•• 26.5	63 40.0	156	•11 17.7	−123
16	225 26.8	94 01.3	18 00.5	77 52.3	20.8	141 47.7	43.9	21 40.4	26.6	78 14.6	156	11 05.4	−124
17	240 29.3	109 00.7	17 59.9	92 53.2	20.3	156 49.8	43.9	36 42.6	26.7	92 49.2	157	10 53.0	−124
18	255 31.7	124 00.1	+17 59.2	107 54.2	+14 19.8	171 52.0	+22 43.9	51 44.8	− 7 26.8	107 23.9	158	+10 40.6	−124
19	270 34.2	138 59.5	58.6	122 55.1	19.2	186 54.1	43.9	66 47.0	26.9	121 58.7	158	10 28.2	−125
20	285 36.7	153 58.9	57.9	137 56.0	18.7	201 56.3	43.9	81 49.3	27.0	136 33.5	158	10 15.7	−125
21	300 39.1	168 58.3	•• 57.3	152 56.9	•• 18.2	216 58.4	•• 43.9	96 51.5	•• 27.1	151 08.3	159	•10 03.2	−125
22	315 41.6	183 57.7	56.6	167 57.8	17.7	232 00.6	44.0	111 53.7	27.2	165 43.2	159	9 50.7	−126
23	330 44.0	198 57.2	56.0	182 58.8	17.1	247 02.7	44.0	126 56.0	27.3	180 18.1	160	9 38.1	−126
24	345 46.5	213 56.6	+17 55.3	197 59.7	+14 16.6	262 04.9	+22 44.0	141 58.2	− 7 27.4	194 53.1	160	+ 9 25.5	−126
code	—	− 6	− 6	+ 9	− 5	+ 22	0	+ 22	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
4	0	180 11.9	+ 7 22.9
	1	195 12.1	22.0
	2	210 12.3	21.0
	3	225 12.5	20.1
	4	240 12.7	19.2
	5	255 12.9	18.3
	6	270 13.2	+ 7 17.3
	7	285 13.4	16.4
	8	300 13.6	15.5
	9	315 13.8	14.6
	10	330 14.0	13.7
	11	345 14.2	12.7
	12	0 14.4	+ 7 11.8
	13	15 14.6	10.9
	14	30 14.8	10.0
	15	45 15.0	09.0
	16	60 15.2	08.1
	17	75 15.4	07.2
	18	90 15.6	+ 7 06.3
	19	105 15.8	05.3
	20	120 16.0	04.4
	21	135 16.2	03.5
	22	150 16.4	02.6
	23	165 16.6	01.6
5	0	180 16.8	+ 7 00.7
	1	195 17.0	6 59.8
	2	210 17.3	58.9
	3	225 17.5	57.9
	4	240 17.7	57.0
	5	255 17.9	56.1
	6	270 18.1	+ 6 55.2
	7	285 18.3	54.2
	8	300 18.5	53.3
	9	315 18.7	52.4
	10	330 18.9	51.5
	11	345 19.1	50.5
	12	0 19.3	+ 6 49.6
	13	15 19.5	48.7
	14	30 19.7	47.7
	15	45 19.9	46.8
	16	60 20.1	45.9
	17	75 20.4	45.0
	18	90 20.6	+ 6 44.0
	19	105 20.8	43.1
	20	120 21.0	42.2
	21	135 21.2	41.2
	22	150 21.4	40.3
	23	165 21.6	39.4
6	0	180 21.8	+ 6 38.5
	1	195 22.0	37.5
	2	210 22.2	36.6
	3	225 22.4	35.7
	4	240 22.6	34.7
	5	255 22.9	33.8
	6	270 23.1	+ 6 32.9
	7	285 23.3	31.9
	8	300 23.5	31.0
	9	315 23.7	30.1
	10	330 23.9	29.2
	11	345 24.1	28.2
	12	0 24.3	+ 6 27.3
	13	15 24.5	26.4
	14	30 24.7	25.4
	15	45 24.9	24.5
	16	60 25.2	23.6
	17	75 25.4	22.6
	18	90 25.6	+ 6 21.7
	19	105 25.8	20.8
	20	120 26.0	19.8
	21	135 26.2	18.9
	22	150 26.4	18.0
	23	165 26.6	17.0
	24	180 26.8	+ 6 16.1
code		—	− 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.0	−40 29.0
5	Achernar	335 59.4	−57 27.9
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 48.0	−28 54.2
10	Aldebaran	291 40.8	+16 25.2
32	Alioth	167 00.2	+56 12.8
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.9	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.3
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.3	−42 33.1
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.5	−68 57.1
22	Avior	234 37.0	−59 21.3
13	Bellatrix	279 20.1	+ 6 18.8
16	Betelg'se	271 49.9	+ 7 24.2
17	Canopus	264 16.3	−52 39.8
12	Capella	281 40.8	+45 57.2
53	Deneb	50 01.7	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 47.0	+62 00.1
14	Elnath	279 09.4	+28 34.3
47	Eltanin	91 06.8	+51 29.8
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.2	−60 09.3
6	Hamal	328 51.2	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 18.1	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.8	+ 3 54.8
36	Menkent	149 00.8	−36 08.7
24	Miapl'dus	221 50.4	−69 31.4
9	Mirfak	309 44.5	+49 41.9
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.2
21	Pollux	244 22.7	+28 08.4
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.2	− 8 14.9
38	Rigil Kent.	140 53.6	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.4	+56 17.1
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.4	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.9	−43 14.5
49	Vega	81 09.1	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT h	Equation of Time (App.—Mean) 4 m s	5 m s	6 m s
0	+ 0 47.3	+ 1 07.0	+ 1 26.8
6	+ 0 52.2	+ 1 11.9	+ 1 31.8
12	+ 0 57.1	+ 1 16.9	+ 1 36.8
18	+ 1 02.0	+ 1 21.8	+ 1 41.9
24	+ 1 07.0	+ 1 26.8	+ 1 46.9

Lat.	Sunrise h m	Twlt. begins h m	Moonrise 4 h m	5 h m	6 h m	7 h m
N 72	4 19	////	▭	▭	1 01	3 14
70	4 31	////	23 00	25 31	1 31	3 28
68	4 40	////	23 50	25 53	1 53	3 39
66	4 47	////	24 22	0 22	2 10	3 48
64	4 53	1 01	24 45	0 45	2 23	3 56
62	4 59	1 43	25 04	1 04	2 35	4 02
60	5 04	2 11	25 19	1 19	2 45	4 08
58	5 08	2 31	0 08	1 31	2 53	4 13
56	5 11	2 48	0 23	1 42	3 01	4 17
54	5 15	3 01	0 35	1 52	3 07	4 21
52	5 18	3 12	0 47	2 00	3 13	4 24
50	5 20	3 22	0 57	2 08	3 19	4 28
45	5 26	3 41	1 17	2 24	3 30	4 34
40	5 31	3 56	1 34	2 38	3 40	4 40
35	5 35	4 08	1 48	2 49	3 48	4 45
30	5 39	4 16	2 01	2 59	3 55	4 49
20	5 45	4 30	2 21	3 15	4 07	4 57
10	5 51	4 40	2 39	3 30	4 18	5 03
0	5 55	4 47	2 56	3 44	4 28	5 09
10	6 00	4 51	3 13	3 57	4 38	5 16
20	6 05	4 53	3 31	4 12	4 48	5 22
30	6 11	4 52	3 51	4 28	5 00	5 29
35	6 14	4 51	4 03	4 37	5 07	5 34
40	6 18	4 49	4 17	4 48	5 15	5 38
45	6 22	4 46	4 33	5 01	5 24	5 44
50	6 27	4 41	4 53	5 16	5 35	5 50
52	6 29	4 39	5 03	5 24	5 40	5 53
54	6 31	4 36	5 13	5 32	5 45	5 57
56	6 34	4 33	5 25	5 40	5 51	6 00
58	6 37	4 29	5 39	5 50	5 58	6 04
60	6 40	4 24	5 55	6 02	6 06	6 09

Lat.	Sunset h m	Twlt. ends h m	Moonset 4 h m	5 h m	6 h m	7 h m
N 72	19 35	////	▭	19 54	19 09	18 38
70	19 24	////	20 20	19 22	18 53	18 31
68	19 15	////	19 28	18 59	18 40	18 25
66	19 08	////	18 56	18 41	18 29	18 20
64	19 02	22 44	18 31	18 26	18 20	18 15
62	18 57	22 06	18 12	18 13	18 13	18 12
60	18 52	21 40	17 57	18 02	18 06	18 08
58	18 48	21 21	17 43	17 53	18 00	18 05
56	18 45	21 06	17 31	17 45	17 55	18 03
54	18 42	20 54	17 21	17 37	17 50	18 00
52	18 39	20 43	17 12	17 31	17 46	17 58
50	18 36	20 33	17 04	17 25	17 42	17 56
45	18 30	20 14	16 46	17 12	17 33	17 52
40	18 26	20 00	16 32	17 01	17 26	17 48
35	18 22	19 49	16 20	16 52	17 20	17 45
30	18 18	19 40	16 09	16 44	17 14	17 42
20	18 12	19 26	15 51	16 29	17 05	17 37
10	18 07	19 18	15 35	16 17	16 56	17 33
0	18 02	19 11	15 19	16 05	16 48	17 29
10	17 57	19 07	15 04	15 53	16 40	17 25
20	17 53	19 06	14 48	15 41	16 31	17 20
30	17 47	19 07	14 29	15 26	16 21	17 15
35	17 44	19 08	14 18	15 17	16 16	17 12
40	17 41	19 11	14 05	15 08	16 09	17 09
45	17 37	19 15	13 49	14 56	16 01	17 05
50	17 32	19 20	13 31	14 42	15 52	17 00
52	17 30	19 23	13 22	14 36	15 48	16 58
54	17 27	19 25	13 12	14 28	15 43	16 55
56	17 25	19 29	13 00	14 20	15 38	16 53
58	17 22	19 33	12 47	14 11	15 32	16 50
60	17 19	19 38	12 32	14 00	15 25	16 46

GMT of Transit
Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
4	9 08	9 42	10 52	6 41	14 41
5	9 54	9 43	10 50	6 38	14 37
6	10 38	9 44	10 49	6 34	14 34
7	11 19	9 45	10 47	6 31	14 30

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb
Add

Alt. °	4 ′	5 ′	6 ′
0	13.1	12.6	12.2
4	13.1	12.6	12.3
8	13.2	12.7	12.3
12	13.2	12.7	12.3
16	13.2	12.7	12.4
20	13.3	12.8	12.4
24	13.3	12.9	12.5
28	13.4	12.9	12.6
32	13.5	13.0	12.7
36	13.5	13.1	12.8
40	13.6	13.2	12.9
44	13.7	13.3	13.0
48	13.8	13.4	13.2
52	13.9	13.6	13.3
56	14.0	13.7	13.5
60	14.1	13.8	13.6
64	14.3	14.0	13.8
68	14.4	14.1	14.0
72	14.5	14.3	14.1
76	14.6	14.4	14.3
80	14.8	14.6	14.5
84	14.9	14.8	14.7
88	15.0	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt. °	4 ′	5 ′	6 ′
0	16.9	17.2	17.4
4	16.9	17.2	17.4
8	16.9	17.2	17.4
12	16.9	17.2	17.4
16	16.8	17.1	17.3
20	16.8	17.1	17.3
24	16.7	17.0	17.2
28	16.7	16.9	17.1
32	16.6	16.8	17.0
36	16.5	16.7	16.9
40	16.4	16.6	16.8
44	16.4	16.5	16.6
48	16.3	16.4	16.5
52	16.2	16.3	16.4
56	16.0	16.1	16.2
60	15.9	16.0	16.1
64	15.8	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.2	15.2
84	15.2	15.1	15.0
88	15.1	15.0	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
7 0	345 46.5	213 56.6	+17 55.3	197 59.7	+14 16.6	262 04.9	+22 44.0	141 58.2	− 7 27.4	194 53.1	160	+ 9 25.5	−126
1	0 49.0	228 56.0	54.6	213 00.6	16.1	277 07.0	44.0	157 00.4	27.5	209 28.1	160	9 12.9	−127
2	15 51.4	243 55.4	54.0	228 01.5	15.5	292 09.2	44.0	172 02.6	27.6	224 03.1	161	9 00.2	−127
3	30 53.9	258 54.8	·· 53.3	243 02.5	·· 15.0	307 11.3	·· 44.0	187 04.9	·· 27.7	238 38.2	162	· 8 47.5	−127
4	45 56.4	273 54.2	52.7	258 03.4	14.5	322 13.5	44.0	202 07.1	27.8	253 13.4	161	8 34.8	−127
5	60 58.8	288 53.6	52.0	273 04.3	14.0	337 15.6	44.0	217 09.3	27.9	267 48.5	162	8 22.1	−128
6	76 01.3	303 53.0	+17 51.3	288 05.2	+14 13.4	352 17.8	+22 44.1	232 11.6	− 7 28.0	282 23.7	163	+ 8 09.3	−128
7	91 03.8	318 52.5	50.7	303 06.1	12.9	7 20.0	44.1	247 13.8	28.1	296 59.0	163	7 56.5	−128
8	106 06.2	333 51.9	50.0	318 07.1	12.4	22 22.1	44.1	262 16.0	28.2	311 34.3	163	7 43.7	−129
9	121 08.7	348 51.3	·· 49.3	333 08.0	·· 11.8	37 24.3	·· 44.1	277 18.2	·· 28.3	326 09.6	163	· 7 30.8	−129
10	136 11.1	3 50.7	48.7	348 08.9	11.3	52 26.4	44.1	292 20.5	28.4	340 44.9	164	7 17.9	−129
11	151 13.6	18 50.1	48.0	3 09.8	10.8	67 28.6	44.1	307 22.7	28.5	355 20.3	164	7 05.0	−129
12	166 16.1	33 49.5	+17 47.3	18 10.8	+14 10.2	82 30.7	+22 44.1	322 24.9	− 7 28.6	9 55.7	165	+ 6 52.1	−129
13	181 18.5	48 48.9	46.7	33 11.7	09.7	97 32.9	44.1	337 27.1	28.7	24 31.2	165	6 39.2	−130
14	196 21.0	63 48.4	46.0	48 12.6	09.2	112 35.1	44.2	352 29.4	28.8	39 06.7	165	6 26.2	−130
15	211 23.5	78 47.8	·· 45.3	63 13.5	·· 08.7	127 37.2	·· 44.2	7 31.6	·· 28.9	53 42.2	165	· 6 13.2	−130
16	226 25.9	93 47.2	44.7	78 14.4	08.1	142 39.4	44.2	22 33.8	29.0	68 17.7	166	6 00.2	−130
17	241 28.4	108 46.6	44.0	93 15.4	07.6	157 41.5	44.2	37 36.1	29.1	82 53.3	166	5 47.2	−130
18	256 30.9	123 46.0	+17 43.3	108 16.3	+14 07.1	172 43.7	+22 44.2	52 38.3	− 7 29.2	97 28.9	166	+ 5 34.2	−131
19	271 33.3	138 45.4	42.6	123 17.2	06.5	187 45.8	44.2	67 40.5	29.3	112 04.5	166	5 21.1	−131
20	286 35.8	153 44.9	42.0	138 18.1	06.0	202 48.0	44.2	82 42.7	29.4	126 40.1	167	5 08.0	−130
21	301 38.3	168 44.3	·· 41.3	153 19.1	·· 05.5	217 50.2	·· 44.2	97 45.0	·· 29.5	141 15.8	167	· 4 55.0	−131
22	316 40.7	183 43.7	40.6	168 20.0	04.9	232 52.3	44.2	112 47.2	29.6	155 51.5	167	4 41.9	−132
23	331 43.2	198 43.1	39.9	183 20.9	04.4	247 54.5	44.3	127 49.4	29.7	170 27.2	167	4 28.7	−131
8 0	346 45.6	213 42.5	+17 39.3	198 21.8	+14 03.9	262 56.6	+22 44.3	142 51.6	− 7 29.8	185 02.9	168	+ 4 15.6	−131
1	1 48.1	228 42.0	38.6	213 22.8	03.3	277 58.8	44.3	157 53.9	29.9	199 38.7	168	4 02.5	−132
2	16 50.6	243 41.4	37.9	228 23.7	02.8	293 01.0	44.3	172 56.1	30.0	214 14.5	168	3 49.3	−131
3	31 53.0	258 40.8	·· 37.2	243 24.6	·· 02.3	308 03.1	·· 44.3	187 58.3	·· 30.1	228 50.3	168	· 3 36.2	−132
4	46 55.5	273 40.2	36.5	258 25.5	01.8	323 05.3	44.3	203 00.5	30.2	243 26.1	168	3 23.0	−132
5	61 58.0	288 39.6	35.9	273 26.5	01.2	338 07.5	44.3	218 02.8	30.3	258 01.9	169	3 09.8	−132
6	77 00.4	303 39.1	+17 35.2	288 27.4	+14 00.7	353 09.6	+22 44.3	233 05.0	− 7 30.4	272 37.8	168	+ 2 56.6	−132
7	92 02.9	318 38.5	34.5	303 28.3	14 00.2	8 11.8	44.4	248 07.2	30.5	287 13.6	169	2 43.4	−132
8	107 05.4	333 37.9	33.8	318 29.2	13 59.6	23 13.9	44.4	263 09.4	30.6	301 49.5	169	2 30.2	−132
9	122 07.8	348 37.3	·· 33.1	333 30.2	·· 59.1	38 16.1	·· 44.4	278 11.7	·· 30.7	316 25.4	169	· 2 17.0	−132
10	137 10.3	3 36.7	32.4	348 31.1	58.6	53 18.3	44.4	293 13.9	30.8	331 01.3	169	2 03.8	−132
11	152 12.8	18 36.2	31.7	3 32.0	58.0	68 20.4	44.4	308 16.1	30.9	345 37.2	170	1 50.6	−133
12	167 15.2	33 35.6	+17 31.0	18 32.9	+13 57.5	83 22.6	+22 44.4	323 18.3	− 7 31.0	0 13.2	169	+ 1 37.3	−132
13	182 17.7	48 35.0	30.4	33 33.9	57.0	98 24.8	44.4	338 20.6	31.1	14 49.1	170	1 24.1	−132
14	197 20.1	63 34.4	29.7	48 34.8	56.4	113 26.9	44.4	353 22.8	31.2	29 25.1	169	1 10.9	−132
15	212 22.6	78 33.8	·· 29.0	63 35.7	·· 55.9	128 29.1	·· 44.5	8 25.0	·· 31.3	44 01.0	170	· 0 57.7	−133
16	227 25.1	93 33.3	28.3	78 36.6	55.4	143 31.3	44.5	23 27.2	31.4	58 37.0	169	0 44.4	−132
17	242 27.5	108 32.7	27.6	93 37.6	54.8	158 33.4	44.5	38 29.5	31.5	73 12.9	170	0 31.2	−132
18	257 30.0	123 32.1	+17 26.9	108 38.5	+13 54.3	173 35.6	+22 44.5	53 31.7	− 7 31.6	87 48.9	170	+ 0 18.0	−133
19	272 32.5	138 31.5	26.2	123 39.4	53.8	188 37.7	44.5	68 33.9	31.7	102 24.9	170	+ 0 04.7	−132
20	287 34.9	153 31.0	25.5	138 40.3	53.2	203 39.9	44.5	83 36.1	31.8	117 00.9	170	− 0 08.5	−132
21	302 37.4	168 30.4	·· 24.8	153 41.3	·· 52.7	218 42.1	·· 44.5	98 38.4	·· 31.8	131 36.9	170	· 0 21.7	−133
22	317 39.9	183 29.8	24.1	168 42.2	52.1	233 44.2	44.5	113 40.6	31.9	146 12.9	170	0 35.0	−132
23	332 42.3	198 29.2	23.4	183 43.1	51.6	248 46.4	44.5	128 42.8	32.0	160 48.9	170	0 48.2	−132
9 0	347 44.8	213 28.6	+17 22.7	198 44.1	+13 51.1	263 48.6	+22 44.6	143 45.0	− 7 32.1	175 24.9	170	− 1 01.4	−132
1	2 47.2	228 28.1	22.0	213 45.0	50.5	278 50.7	44.6	158 47.3	32.2	190 00.9	169	1 14.6	−132
2	17 49.7	243 27.5	21.3	228 45.9	50.0	293 52.9	44.6	173 49.5	32.3	204 36.8	170	1 27.8	−132
3	32 52.2	258 26.9	·· 20.6	243 46.8	·· 49.5	308 55.1	·· 44.6	188 51.7	·· 32.4	219 12.8	170	· 1 41.0	−132
4	47 54.6	273 26.3	19.9	258 47.8	48.9	323 57.3	44.6	203 53.9	32.5	233 48.8	170	1 54.2	−132
5	62 57.1	288 25.8	19.2	273 48.7	48.4	338 59.4	44.6	218 56.2	32.6	248 24.8	170	2 07.4	−131
6	77 59.6	303 25.2	+17 18.5	288 49.6	+13 47.9	354 01.6	+22 44.6	233 58.4	− 7 32.7	263 00.8	169	− 2 20.5	−132
7	93 02.0	318 24.6	17.8	303 50.6	47.3	9 03.8	44.6	249 00.6	32.8	277 36.7	170	2 33.7	−132
8	108 04.5	333 24.1	17.1	318 51.5	46.8	24 05.9	44.6	264 02.8	32.9	292 12.7	170	2 46.9	−131
9	123 07.0	348 23.5	·· 16.4	333 52.4	·· 46.3	39 08.1	·· 44.7	279 05.1	·· 33.0	306 48.7	169	· 3 00.0	−131
10	138 09.4	3 22.9	15.7	348 53.3	45.7	54 10.3	44.7	294 07.3	33.1	321 24.6	169	3 13.1	−131
11	153 11.9	18 22.3	15.0	3 54.3	45.2	69 12.4	44.7	309 09.5	33.2	336 00.5	170	3 26.2	−131
12	168 14.4	33 21.8	+17 14.2	18 55.2	+13 44.6	84 14.6	+22 44.7	324 11.7	− 7 33.3	350 36.5	169	− 3 39.3	−131
13	183 16.8	48 21.2	13.5	33 56.1	44.1	99 16.8	44.7	339 14.0	33.4	5 12.4	169	3 52.4	−131
14	198 19.3	63 20.6	12.8	48 57.1	43.6	114 19.0	44.7	354 16.2	33.5	19 48.3	169	4 05.5	−131
15	213 21.7	78 20.0	·· 12.1	63 58.0	·· 43.0	129 21.1	·· 44.7	9 18.4	·· 33.6	34 24.2	168	· 4 18.6	−130
16	228 24.2	93 19.5	11.4	78 58.9	42.5	144 23.3	44.7	24 20.6	33.7	49 00.0	169	4 31.6	−130
17	243 26.7	108 18.9	10.7	93 59.8	42.0	159 25.5	44.7	39 22.8	33.8	63 35.9	169	4 44.6	−130
18	258 29.1	123 18.3	+17 10.0	109 00.8	+13 41.4	174 27.6	+22 44.8	54 25.1	− 7 33.9	78 11.8	168	− 4 57.6	−130
19	273 31.6	138 17.8	09.2	124 01.7	40.9	189 29.8	44.8	69 27.3	34.0	92 47.6	168	5 10.6	−130
20	288 34.1	153 17.2	08.5	139 02.6	40.4	204 32.0	44.8	84 29.5	34.1	107 23.4	168	5 23.6	−129
21	303 36.5	168 16.6	·· 07.8	154 03.6	·· 39.8	219 34.2	·· 44.8	99 31.7	·· 34.2	121 59.2	168	· 5 36.5	−130
22	318 39.0	183 16.0	07.1	169 04.5	39.3	234 36.3	44.8	114 34.0	34.3	136 35.0	167	5 49.5	−129
23	333 41.5	198 15.5	06.4	184 05.4	38.7	249 38.5	44.8	129 36.2	34.4	151 10.7	167	6 02.4	−128
24	348 43.9	213 14.9	+17 05.7	199 06.4	+13 38.2	264 40.7	+22 44.8	144 38.4	− 7 34.5	165 46.4	168	− 6 15.2	−129
code	−	− 6	− 6	+ 10	− 5	+ 22	0	+ 23	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
7	0	180 26.8	+ 6 16.1
	1	195 27.0	15.2
	2	210 27.3	14.2
	3	225 27.5	13.3
	4	240 27.7	12.3
	5	255 27.9	11.4
	6	270 28.1	+ 6 10.5
	7	285 28.3	09.5
	8	300 28.5	08.6
	9	315 28.7	07.7
	10	330 28.9	06.7
	11	345 29.2	05.8
	12	0 29.4	+ 6 04.9
	13	15 29.6	03.9
	14	30 29.8	03.0
	15	45 30.0	02.1
	16	60 30.2	01.1
	17	75 30.4	6 00.2
	18	90 30.6	+ 5 59.2
	19	105 30.8	58.3
	20	120 31.1	57.4
	21	135 31.3	56.4
	22	150 31.5	55.5
	23	165 31.7	54.5
8	0	180 31.9	+ 5 53.6
	1	195 32.1	52.7
	2	210 32.3	51.7
	3	225 32.5	50.8
	4	240 32.8	49.9
	5	255 33.0	48.9
	6	270 33.2	+ 5 48.0
	7	285 33.4	47.0
	8	300 33.6	46.1
	9	315 33.8	45.2
	10	330 34.0	44.2
	11	345 34.2	43.3
	12	0 34.5	+ 5 42.3
	13	15 34.7	41.4
	14	30 34.9	40.5
	15	45 35.1	39.5
	16	60 35.3	38.6
	17	75 35.5	37.6
	18	90 35.7	+ 5 36.7
	19	105 36.0	35.7
	20	120 36.2	34.8
	21	135 36.4	33.9
	22	150 36.6	32.9
	23	165 36.8	32.0
9	0	180 37.0	+ 5 31.0
	1	195 37.2	30.1
	2	210 37.5	29.2
	3	225 37.7	28.2
	4	240 37.9	27.3
	5	255 38.1	26.3
	6	270 38.3	+ 5 25.4
	7	285 38.5	24.4
	8	300 38.7	23.5
	9	315 39.0	22.5
	10	330 39.2	21.6
	11	345 39.4	20.7
	12	0 39.6	+ 5 19.7
	13	15 39.8	18.8
	14	30 40.0	17.8
	15	45 40.2	16.9
	16	60 40.5	15.9
	17	75 40.7	15.0
	18	90 40.9	+ 5 14.0
	19	105 41.1	13.1
	20	120 41.3	12.2
	21	135 41.5	11.2
	22	150 41.8	10.3
	23	165 42.0	09.3
	24	180 42.2	+ 5 08.4
code		—	- 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.0	−40 29.0
5	Achernar	335 59.4	−57 27.9
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 47.9	−28 54.2
10	Aldebaran	291 40.8	+16 25.2
32	Alioth	167 00.2	+56 12.7
34	Alkaid	153 34.3	+49 32.8
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.9	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.7	+28 50.3
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.3	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.5	−68 57.1
22	Avior	234 37.0	−59 21.3
13	Bellatrix	279 20.1	+ 6 18.8
16	Betelg'se	271 49.9	+ 7 24.2
17	Canopus	264 16.3	−52 39.8
12	Capella	281 40.8	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 47.0	+62 00.1
14	Elnath	279 09.3	+28 34.3
47	Eltanin	91 06.8	+51 29.9
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.2	−60 09.3
6	Hamal	328 51.2	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 18.2	+74 20.9
57	Markab	14 22.7	+14 57.5
8	Menkar	315 01.8	+ 3 54.8
36	Menkent	149 00.8	−36 08.7
24	Miapl'dus	221 50.4	−69 31.4
9	Mirfak	309 44.5	+49 41.9
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.2
21	Pollux	244 22.7	+28 08.4
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.5	+12 11.7
11	Rigel	281 55.1	− 8 14.9
38	Rigil Kent.	140 53.7	−60 39.1
44	Sabik	103 03.9	−15 40.2
3	Schedar	350 31.4	+56 17.1
45	Shaula	97 22.7	−37 04.5
18	Sirius	259 13.4	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.9	−43 14.5
49	Vega	81 09.2	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT h	Equation of Time (App.—Mean) 7 m s	8 m s	9 m s
0	+ 1 46.9	+ 2 07.2	+ 2 27.7
6	+ 1 52.0	+ 2 12.3	+ 2 32.8
12	+ 1 57.0	+ 2 17.4	+ 2 38.0
18	+ 2 02.1	+ 2 22.5	+ 2 43.1
24	+ 2 07.2	+ 2 27.7	+ 2 48.3

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 7 h m	8 h m	9 h m	10 h m
72	4 34	////	3 14	5 11	7 02	8 58
70	4 43	////	3 28	5 15	6 59	8 45
68	4 51	////	3 39	5 19	6 56	8 34
66	4 57	0 21	3 48	5 22	6 53	8 26
64	5 02	1 28	3 56	5 24	6 51	8 18
62	5 07	2 01	4 02	5 26	6 49	8 12
60	5 11	2 24	4 08	5 28	6 47	8 07
58	5 14	2 42	4 13	5 30	6 46	8 03
56	5 17	2 56	4 17	5 31	6 45	7 58
54	5 20	3 08	4 21	5 33	6 44	7 55
52	5 23	3 19	4 24	5 34	6 43	7 51
50	5 25	3 27	4 28	5 35	6 42	7 48
45	5 30	3 46	4 34	5 37	6 40	7 42
40	5 34	3 59	4 40	5 39	6 38	7 36
35	5 38	4 10	4 45	5 41	6 36	7 32
30	5 41	4 19	4 49	5 43	6 35	7 28
20	5 46	4 32	4 57	5 45	6 33	7 21
10	5 50	4 40	5 03	5 48	6 31	7 15
0	5 54	4 46	5 09	5 50	6 29	7 09
10	5 58	4 49	5 16	5 52	6 27	7 03
20	6 03	4 50	5 22	5 54	6 26	6 57
30	6 07	4 49	5 29	5 57	6 23	6 51
35	6 10	4 47	5 34	5 58	6 22	6 47
40	6 13	4 44	5 38	6 00	6 21	6 42
45	6 16	4 40	5 44	6 02	6 19	6 37
50	6 20	4 34	5 50	6 04	6 18	6 31
52	6 22	4 31	5 53	6 05	6 17	6 29
54	6 24	4 28	5 57	6 06	6 16	6 26
56	6 26	4 24	6 00	6 08	6 15	6 22
58	6 28	4 19	6 04	6 09	6 14	6 19
60	6 31	4 14	6 09	6 11	6 12	6 14

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 7 h m	8 h m	9 h m	10 h m
72	19 19	////	18 38	18 11	17 45	17 14
70	19 10	////	18 31	18 11	17 51	17 29
68	19 03	////	18 25	18 11	17 57	17 42
66	18 57	23 12	18 20	18 11	18 02	17 52
64	18 52	22 18	18 15	18 10	18 06	18 00
62	18 47	21 47	18 12	18 10	18 09	18 08
60	18 43	21 25	18 08	18 10	18 12	18 14
58	18 40	21 09	18 05	18 10	18 15	18 20
56	18 37	20 55	18 03	18 10	18 17	18 25
54	18 34	20 43	18 00	18 10	18 19	18 29
52	18 32	20 34	17 58	18 10	18 21	18 34
50	18 30	20 25	17 56	18 10	18 23	18 37
45	18 25	20 08	17 52	18 10	18 27	18 46
40	18 21	19 54	17 48	18 09	18 31	18 53
35	18 17	19 43	17 45	18 09	18 33	18 58
30	18 14	19 35	17 42	18 09	18 36	19 04
20	18 09	19 23	17 37	18 09	18 40	19 13
10	18 05	19 15	17 33	18 09	18 44	19 21
0	18 01	19 10	17 29	18 09	18 48	19 28
10	17 57	19 07	17 25	18 09	18 52	19 36
20	17 53	19 06	17 20	18 08	18 56	19 44
30	17 49	19 08	17 15	18 08	19 00	19 53
35	17 46	19 10	17 12	18 08	19 03	19 59
40	17 43	19 13	17 09	18 08	19 06	20 05
45	17 40	19 18	17 05	18 07	19 10	20 12
50	17 36	19 24	17 00	18 07	19 14	20 21
52	17 35	19 28	16 58	18 07	19 16	20 25
54	17 33	19 31	16 55	18 07	19 18	20 29
56	17 31	19 36	16 53	18 07	19 20	20 34
58	17 28	19 40	16 50	18 07	19 23	20 40
60	17 26	19 46	16 46	18 06	19 26	20 46

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
7	11 19	9 45	10 47	6 31	14 30
8	11 59	9 46	10 46	6 27	14 26
9	12 39	9 47	10 44	6 24	14 23
10	13 19	9 47	10 43	6 20	14 19

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	7 ′	8 ′	9 ′
0	11.9	11.7	11.6
4	11.9	11.7	11.6
8	11.9	11.8	11.7
12	11.9	11.8	11.7
16	12.0	11.9	11.8
20	12.1	12.0	11.8
24	12.2	12.0	11.9
28	12.2	12.1	12.0
32	12.4	12.2	12.1
36	12.5	12.4	12.3
40	12.6	12.5	12.4
44	12.7	12.6	12.6
48	12.9	12.8	12.7
52	13.1	13.0	12.9
56	13.2	13.1	13.1
60	13.4	13.3	13.3
64	13.6	13.5	13.4
68	13.8	13.7	13.6
72	14.0	13.9	13.9
76	14.2	14.1	14.1
80	14.4	14.3	14.3
84	14.6	14.5	14.5
88	14.7	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	7 ′	8 ′	9 ′
0	17.7	17.7	17.8
4	17.6	17.7	17.8
8	17.6	17.7	17.8
12	17.6	17.6	17.7
16	17.5	17.6	17.7
20	17.5	17.5	17.6
24	17.4	17.4	17.5
28	17.3	17.3	17.4
32	17.2	17.2	17.3
36	17.0	17.1	17.2
40	16.9	17.0	17.0
44	16.8	16.8	16.9
48	16.6	16.7	16.7
52	16.5	16.5	16.5
56	16.3	16.3	16.4
60	16.1	16.1	16.2
64	15.9	16.0	16.0
68	15.8	15.8	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.1
84	15.0	14.9	14.9
88	14.8	14.8	14.8
90			

Subtract from table, back cover

Labor Day 7

New Moon 8

GMT	♈ GHA	VENUS −3.4 GHA	VENUS −3.4 Dec.	MARS 2.0 GHA	MARS 2.0 Dec.	JUPITER −1.9 GHA	JUPITER −1.9 Dec.	SATURN 1.0 GHA	SATURN 1.0 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
10 0	348 43.9	213 14.9	+17 05.7	199 06.4	+13 38.2	264 40.7	+22 44.8	144 38.4	− 7 34.5	165 46.4	168	− 6 15.2	−129
1	3 46.4	228 14.3	04.9	214 07.3	37.7	279 42.9	44.8	159 40.6	34.6	180 22.2	166	6 28.1	−128
2	18 48.8	243 13.8	04.2	229 08.2	37.1	294 45.0	44.8	174 42.9	34.7	194 57.8	167	6 40.9	−129
3	33 51.3	258 13.2	•• 03.5	244 09.2	•• 36.6	309 47.2	•• 44.9	189 45.1	•• 34.8	209 33.5	166	• 6 53.8	−127
4	48 53.8	273 12.6	02.8	259 10.1	36.0	324 49.4	44.9	204 47.3	34.9	224 09.1	167	7 06.5	−128
5	63 56.2	288 12.1	02.0	274 11.0	35.5	339 51.6	44.9	219 49.5	35.0	238 44.8	165	7 19.3	−127
6	78 58.7	303 11.5	+17 01.3	289 11.9	+13 35.0	354 53.7	+22 44.9	234 51.7	− 7 35.1	253 20.3	166	− 7 32.0	−127
7	94 01.2	318 10.9	17 00.6	304 12.9	34.4	9 55.9	44.9	249 54.0	35.2	267 55.9	165	7 44.7	−127
8	109 03.6	333 10.4	16 59.9	319 13.8	33.9	24 58.1	44.9	264 56.2	35.3	282 31.4	165	7 57.4	−127
9	124 06.1	348 09.8	•• 59.1	334 14.7	•• 33.3	40 00.3	•• 44.9	279 58.4	•• 35.4	297 06.9	165	• 8 10.1	−126
10	139 08.6	3 09.2	58.4	349 15.7	32.8	55 02.4	44.9	295 00.6	35.5	311 42.4	165	8 22.7	−126
11	154 11.0	18 08.7	57.7	4 16.6	32.3	70 04.6	44.9	310 02.8	35.6	326 17.9	164	8 35.3	−125
12	169 13.5	33 08.1	+16 56.9	19 17.5	+13 31.7	85 06.8	+22 45.0	325 05.1	− 7 35.7	340 53.3	163	− 8 47.8	−126
13	184 16.0	48 07.5	56.2	34 18.5	31.2	100 09.0	45.0	340 07.3	35.8	355 28.6	164	9 00.4	−125
14	199 18.4	63 07.0	55.5	49 19.4	30.6	115 11.2	45.0	355 09.5	35.9	10 04.0	163	9 12.9	−124
15	214 20.9	78 06.4	•• 54.8	64 20.3	•• 30.1	130 13.3	•• 45.0	10 11.7	•• 36.0	24 39.3	163	• 9 25.3	−125
16	229 23.3	93 05.8	54.0	79 21.3	29.6	145 15.5	45.0	25 14.0	36.1	39 14.6	162	9 37.8	−124
17	244 25.8	108 05.3	53.3	94 22.2	29.0	160 17.7	45.0	40 16.2	36.2	53 49.8	162	9 50.2	−123
18	259 28.3	123 04.7	+16 52.5	109 23.1	+13 28.5	175 19.9	+22 45.0	55 18.4	− 7 36.3	68 25.0	162	−10 02.5	−123
19	274 30.7	138 04.1	51.8	124 24.1	27.9	190 22.1	45.0	70 20.6	36.4	83 00.2	161	10 14.8	−123
20	289 33.2	153 03.6	51.1	139 25.0	27.4	205 24.2	45.0	85 22.8	36.5	97 35.3	161	10 27.1	−123
21	304 35.7	168 03.0	•• 50.3	154 25.9	•• 26.9	220 26.4	•• 45.1	100 25.1	•• 36.6	112 10.4	161	•10 39.4	−122
22	319 38.1	183 02.4	49.6	169 26.9	26.3	235 28.6	45.1	115 27.3	36.7	126 45.5	160	10 51.6	−122
23	334 40.6	198 01.9	48.9	184 27.8	25.8	250 30.8	45.1	130 29.5	36.8	141 20.5	159	11 03.8	−121
11 0	349 43.1	213 01.3	+16 48.1	199 28.7	+13 25.2	265 33.0	+22 45.1	145 31.7	− 7 36.9	155 55.4	160	−11 15.9	−121
1	4 45.5	228 00.8	47.4	214 29.7	24.7	280 35.1	45.1	160 33.9	37.0	170 30.4	158	11 28.0	−120
2	19 48.0	243 00.2	46.6	229 30.6	24.2	295 37.3	45.1	175 36.2	37.1	185 05.2	159	11 40.0	−120
3	34 50.4	257 59.6	•• 45.9	244 31.5	•• 23.6	310 39.5	•• 45.1	190 38.4	•• 37.2	199 40.1	158	•11 52.0	−120
4	49 52.9	272 59.1	45.1	259 32.5	23.1	325 41.7	45.1	205 40.6	37.3	214 14.9	157	12 04.0	−119
5	64 55.4	287 58.5	44.4	274 33.4	22.5	340 43.9	45.1	220 42.8	37.4	228 49.6	157	12 15.9	−119
6	79 57.8	302 57.9	+16 43.7	289 34.4	+13 22.0	355 46.1	+22 45.1	235 45.0	− 7 37.5	243 24.3	157	−12 27.8	−118
7	95 00.3	317 57.4	42.9	304 35.3	21.4	10 48.2	45.2	250 47.3	37.6	257 59.0	156	12 39.6	−118
8	110 02.8	332 56.8	42.2	319 36.2	20.9	25 50.4	45.2	265 49.5	37.7	272 33.6	155	12 51.4	−117
9	125 05.2	347 56.3	•• 41.4	334 37.2	•• 20.4	40 52.6	•• 45.2	280 51.7	•• 37.8	287 08.1	155	•13 03.1	−117
10	140 07.7	2 55.7	40.7	349 38.1	19.8	55 54.8	45.2	295 53.9	37.9	301 42.6	155	13 14.8	−116
11	155 10.2	17 55.1	39.9	4 39.0	19.3	70 57.0	45.2	310 56.1	38.0	316 17.1	154	13 26.4	−116
12	170 12.6	32 54.6	+16 39.2	19 40.0	+13 18.7	85 59.2	+22 45.2	325 58.4	− 7 38.1	330 51.5	154	−13 38.0	−116
13	185 15.1	47 54.0	38.4	34 40.9	18.2	101 01.3	45.2	341 00.6	38.2	345 25.9	153	13 49.6	−115
14	200 17.6	62 53.5	37.7	49 41.8	17.6	116 03.5	45.2	356 02.8	38.3	0 00.2	152	14 01.1	−114
15	215 20.0	77 52.9	•• 36.9	64 42.8	•• 17.1	131 05.7	•• 45.2	11 05.0	•• 38.4	14 34.4	152	•14 12.5	−114
16	230 22.5	92 52.3	36.2	79 43.7	16.6	146 07.9	45.2	26 07.2	38.5	29 08.6	151	14 23.9	−113
17	245 24.9	107 51.8	35.4	94 44.6	16.0	161 10.1	45.3	41 09.5	38.6	43 42.7	151	14 35.2	−113
18	260 27.4	122 51.2	+16 34.6	109 45.6	+13 15.5	176 12.3	+22 45.3	56 11.7	− 7 38.7	58 16.8	151	−14 46.5	−112
19	275 29.9	137 50.7	33.9	124 46.5	14.9	191 14.5	45.3	71 13.9	38.8	72 50.9	149	14 57.7	−111
20	290 32.3	152 50.1	33.1	139 47.5	14.4	206 16.6	45.3	86 16.1	38.9	87 24.8	149	15 08.8	−112
21	305 34.8	167 49.6	•• 32.4	154 48.4	•• 13.8	221 18.8	•• 45.3	101 18.3	•• 39.0	101 58.7	149	•15 20.0	−110
22	320 37.3	182 49.0	31.6	169 49.3	13.3	236 21.0	45.3	116 20.6	39.1	116 32.6	148	15 31.0	−110
23	335 39.7	197 48.4	30.9	184 50.3	12.8	251 23.2	45.3	131 22.8	39.2	131 06.4	147	15 42.0	−109
12 0	350 42.2	212 47.9	+16 30.1	199 51.2	+13 12.2	266 25.4	+22 45.3	146 25.0	− 7 39.3	145 40.1	147	−15 52.9	−109
1	5 44.7	227 47.3	29.3	214 52.1	11.7	281 27.6	45.3	161 27.2	39.4	160 13.8	146	16 03.8	−108
2	20 47.1	242 46.8	28.6	229 53.1	11.1	296 29.8	45.4	176 29.4	39.5	174 47.4	146	16 14.6	−107
3	35 49.6	257 46.2	•• 27.8	244 54.0	•• 10.6	311 32.0	•• 45.4	191 31.7	•• 39.6	189 21.0	144	•16 25.3	−107
4	50 52.1	272 45.7	27.1	259 55.0	10.0	326 34.2	45.4	206 33.9	39.7	203 54.4	145	16 36.0	−106
5	65 54.5	287 45.1	26.3	274 55.9	09.5	341 36.3	45.4	221 36.1	39.8	218 27.9	143	16 46.6	−106
6	80 57.0	302 44.6	+16 25.5	289 56.8	+13 08.9	356 38.5	+22 45.4	236 38.3	− 7 39.9	233 01.2	143	−16 57.2	−105
7	95 59.4	317 44.0	24.8	304 57.8	08.4	11 40.7	45.4	251 40.5	40.0	247 34.5	143	17 07.7	−104
8	111 01.9	332 43.4	24.0	319 58.7	07.8	26 42.9	45.4	266 42.7	40.1	262 07.8	141	17 18.1	−104
9	126 04.4	347 42.9	•• 23.2	334 59.7	•• 07.3	41 45.1	•• 45.4	281 45.0	•• 40.2	276 40.9	141	•17 28.5	−102
10	141 06.8	2 42.3	22.5	350 00.6	06.8	56 47.3	45.4	296 47.2	40.3	291 14.0	141	17 38.7	−103
11	156 09.3	17 41.8	21.7	5 01.5	06.2	71 49.5	45.4	311 49.4	40.4	305 47.1	139	17 49.0	−101
12	171 11.8	32 41.2	+16 20.9	20 02.5	+13 05.7	86 51.7	+22 45.5	326 51.6	− 7 40.5	320 20.0	139	−17 59.1	−101
13	186 14.2	47 40.7	20.1	35 03.4	05.1	101 53.9	45.5	341 53.8	40.6	334 52.9	138	18 09.2	−100
14	201 16.7	62 40.1	19.4	50 04.3	04.6	116 56.1	45.5	356 56.0	40.7	349 25.7	138	18 19.2	− 99
15	216 19.2	77 39.6	•• 18.6	65 05.3	•• 04.0	131 58.3	•• 45.5	11 58.3	•• 40.9	3 58.5	137	•18 29.1	− 99
16	231 21.6	92 39.0	17.8	80 06.2	03.5	147 00.5	45.5	27 00.5	41.0	18 31.2	136	18 39.0	− 98
17	246 24.1	107 38.5	17.1	95 07.2	02.9	162 02.6	45.5	42 02.7	41.1	33 03.8	136	18 48.8	− 97
18	261 26.5	122 37.9	+16 16.3	110 08.1	+13 02.4	177 04.8	+22 45.5	57 04.9	− 7 41.2	47 36.4	134	−18 58.5	− 96
19	276 29.0	137 37.4	15.5	125 09.0	01.8	192 07.0	45.5	72 07.1	41.3	62 08.8	134	19 08.1	− 96
20	291 31.5	152 36.8	14.7	140 10.0	01.3	207 09.2	45.5	87 09.4	41.4	76 41.2	134	19 17.7	− 95
21	306 33.9	167 36.3	•• 13.9	155 10.9	•• 00.7	222 11.4	•• 45.5	102 11.6	•• 41.5	91 13.6	132	•19 27.2	− 94
22	321 36.4	182 35.7	13.2	170 11.9	13 00.2	237 13.6	45.5	117 13.8	41.6	105 45.8	132	19 36.6	− 93
23	336 38.9	197 35.2	12.4	185 12.8	12 59.6	252 15.8	45.6	132 16.0	41.7	120 18.0	131	19 45.9	− 92
24	351 41.3	212 34.6	+16 11.6	200 13.8	+12 59.1	267 18.0	+22 45.6	147 18.2	− 7 41.8	134 50.1	131	−19 55.1	− 92
code	−	− 6	− 8	+ 9	− 5	+ 21	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
10 h 0	180 42.2	+ 5 08.4
1	195 42.4	07.4
2	210 42.6	06.5
3	225 42.8	05.5
4	240 43.0	04.6
5	255 43.3	03.6
6	270 43.5	+ 5 02.7
7	285 43.7	01.7
8	300 43.9	5 00.8
9	315 44.1	4 59.8
10	330 44.3	58.9
11	345 44.6	57.9
12	0 44.8	+ 4 57.0
13	15 45.0	56.1
14	30 45.2	55.1
15	45 45.4	54.2
16	60 45.6	53.2
17	75 45.9	52.3
18	90 46.1	+ 4 51.3
19	105 46.3	50.4
20	120 46.5	49.4
21	135 46.7	48.5
22	150 46.9	47.5
23	165 47.2	46.6
11 0	180 47.4	+ 4 45.6
1	195 47.6	44.7
2	210 47.8	43.7
3	225 48.0	42.8
4	240 48.3	41.8
5	255 48.5	40.9
6	270 48.7	+ 4 39.9
7	285 48.9	39.0
8	300 49.1	38.0
9	315 49.3	37.1
10	330 49.6	36.1
11	345 49.8	35.2
12	0 50.0	+ 4 34.2
13	15 50.2	33.3
14	30 50.4	32.3
15	45 50.6	31.3
16	60 50.9	30.4
17	75 51.1	29.4
18	90 51.3	+ 4 28.5
19	105 51.5	27.5
20	120 51.7	26.6
21	135 52.0	25.6
22	150 52.2	24.7
23	165 52.4	23.7
12 0	180 52.6	+ 4 22.8
1	195 52.8	21.8
2	210 53.0	20.9
3	225 53.3	19.9
4	240 53.5	19.0
5	255 53.7	18.0
6	270 53.9	+ 4 17.1
7	285 54.1	16.1
8	300 54.4	15.1
9	315 54.6	14.2
10	330 54.8	13.2
11	345 55.0	12.3
12	0 55.2	+ 4 11.3
13	15 55.5	10.4
14	30 55.7	09.4
15	45 55.9	08.5
16	60 56.1	07.5
17	75 56.3	06.6
18	90 56.6	+ 4 05.6
19	105 56.8	04.6
20	120 57.0	03.7
21	135 57.2	02.7
22	150 57.4	01.8
23	165 57.6	4 00.8
24	180 57.9	+ 3 59.9
code	—	− 9

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.0	−40 29.0
5	Achernar	335 59.4	−57 27.9
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 47.9	−28 54.2
10	Aldebaran	291 40.8	+16 25.2
32	Alioth	167 00.2	+56 12.7
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.9	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.0	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.7	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.6	−68 57.1
22	Avior	234 37.0	−59 21.3
13	Bellatrix	279 20.1	+ 6 18.8
16	Betelg'se	271 49.9	+ 7 24.2
17	Canopus	264 16.2	−52 39.8
12	Capella	281 40.7	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.5	−18 14.1
27	Dubhe	194 46.9	+62 00.1
14	Elnath	279 09.3	+28 34.3
47	Eltanin	91 06.9	+51 29.9
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.2	−60 09.3
6	Hamal	328 51.2	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.6
40	Kochab	137 18.2	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.8	+ 3 54.8
36	Menkent	149 00.8	−36 08.7
24	Miapl'dus	221 50.4	−69 31.4
9	Mirfak	309 44.5	+49 41.9
50	Nunki	76 53.6	−26 21.4
52	Peacock	54 29.2	−56 53.2
21	Pollux	244 22.7	+28 08.4
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.1	− 8 14.9
38	Rigil Kent.	140 53.7	−60 39.1
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.4	+56 17.1
45	Shaula	97 22.8	−37 04.5
18	Sirius	259 13.3	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.9	−43 14.5
49	Vega	81 09.2	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 10	11	12
h	m s	m s	m s
0	+ 2 48.3	+ 3 09.1	+ 3 30.0
6	+ 2 53.5	+ 3 14.3	+ 3 35.2
12	+ 2 58.7	+ 3 19.5	+ 3 40.5
18	+ 3 03.9	+ 3 24.8	+ 3 45.8
24	+ 3 09.1	+ 3 30.0	+ 3 51.0

Lat.	Sunrise	Twlt. begins	Moonrise 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	4 48	////	8 58	11 07	■	■
70	4 55	////	8 45	10 39	13 00	■
68	5 01	////	8 34	10 18	12 16	■
66	5 06	1 08	8 26	10 02	11 46	13 47
64	5 11	1 50	8 18	9 49	11 25	13 08
62	5 14	2 16	8 12	9 38	11 07	12 40
60	5 18	2 36	8 07	9 29	10 53	12 19
58	5 21	2 51	8 03	9 20	10 40	12 02
56	5 23	3 05	7 58	9 13	10 30	11 48
54	5 25	3 16	7 55	9 07	10 21	11 36
52	5 27	3 26	7 51	9 01	10 12	11 25
50	5 29	3 34	7 48	8 56	10 05	11 15
45	5 33	3 50	7 42	8 45	9 49	10 55
40	5 37	4 03	7 36	8 36	9 37	10 38
35	5 40	4 13	7 32	8 28	9 26	10 25
30	5 42	4 21	7 28	8 21	9 16	10 13
20	5 46	4 32	7 21	8 10	9 00	9 52
10	5 50	4 40	7 15	7 59	8 46	9 35
0	5 53	4 45	7 09	7 50	8 33	9 19
10	5 57	4 47	7 03	7 40	8 20	9 02
20	6 00	4 48	6 57	7 30	8 06	8 45
30	6 04	4 46	6 51	7 19	7 50	8 25
35	6 06	4 43	6 47	7 13	7 41	8 14
40	6 08	4 40	6 42	7 05	7 31	8 01
45	6 11	4 35	6 37	6 57	7 19	7 45
50	6 14	4 28	6 31	6 46	7 04	7 26
52	6 15	4 25	6 29	6 42	6 58	7 17
54	6 17	4 21	6 26	6 37	6 50	7 07
56	6 18	4 16	6 22	6 31	6 42	6 56
58	6 20	4 11	6 19	6 24	6 32	6 43
60 S	6 22	4 05	6 14	6 17	6 22	6 28

Lat.	Sunset	Twlt. ends	Moonset 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	19 03	////	17 14	16 31	■	■
70	18 56	////	17 29	17 01	16 10	■
68	18 50	////	17 42	17 23	16 56	■
66	18 45	22 33	17 52	17 41	17 26	17 02
64	18 41	21 56	18 00	17 55	17 49	17 42
62	18 37	21 31	18 08	18 07	18 07	18 10
60	18 34	21 12	18 14	18 17	18 22	18 31
58	18 31	20 56	18 20	18 26	18 35	18 49
56	18 29	20 44	18 25	18 34	18 47	19 04
54	18 27	20 34	18 29	18 41	18 56	19 17
52	18 25	20 25	18 34	18 48	19 05	19 28
50	18 23	20 17	18 37	18 54	19 13	19 38
45	18 19	20 01	18 46	19 06	19 30	19 59
40	18 16	19 49	18 53	19 17	19 44	20 17
35	18 13	19 39	18 58	19 26	19 56	20 31
30	18 11	19 32	19 04	19 33	20 06	20 44
20	18 07	19 21	19 13	19 47	20 24	21 05
10	18 03	19 13	19 21	19 59	20 40	21 24
0	18 00	19 09	19 28	20 10	20 55	21 42
10	17 57	19 07	19 36	20 22	21 09	22 00
20	17 54	19 07	19 44	20 34	21 25	22 19
30	17 50	19 09	19 53	20 48	21 43	22 41
35	17 48	19 12	19 59	20 56	21 54	22 53
40	17 46	19 16	20 05	21 05	22 06	23 08
45	17 43	19 21	20 12	21 16	22 21	23 26
50	17 40	19 28	20 21	21 29	22 39	23 48
52	17 39	19 32	20 25	21 35	22 47	23 59
54	17 38	19 36	20 29	21 42	22 56	24 11
56	17 36	19 41	20 34	21 50	23 07	24 25
58	17 34	19 46	20 40	21 59	23 19	24 41
60 S	17 32	19 53	20 46	22 08	23 34	25 00

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
10	13 19	9 47	10 43	6 20	14 19
11	14 00	9 48	10 41	6 17	14 16
12	14 44	9 49	10 40	6 13	14 12
13	15 30	9 50	10 38	6 10	14 09

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	10	11	12
°	′	′	′
0	11.7	11.9	12.2
4	11.7	11.9	12.3
8	11.8	11.9	12.3
12	11.8	11.9	12.3
16	11.9	12.0	12.4
20	12.0	12.1	12.4
24	12.0	12.2	12.5
28	12.1	12.2	12.6
32	12.2	12.4	12.7
36	12.4	12.5	12.8
40	12.5	12.6	12.9
44	12.6	12.7	13.0
48	12.8	12.9	13.2
52	13.0	13.1	13.3
56	13.1	13.2	13.5
60	13.3	13.4	13.6
64	13.5	13.6	13.8
68	13.7	13.8	14.0
72	13.9	14.0	14.1
76	14.1	14.2	14.3
80	14.3	14.4	14.5
84	14.5	14.6	14.7
88	14.7	14.7	14.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	10	11	12
°	′	′	′
0	17.7	17.7	17.4
4	17.7	17.6	17.4
8	17.7	17.6	17.4
12	17.6	17.6	17.4
16	17.6	17.5	17.3
20	17.5	17.5	17.3
24	17.4	17.4	17.2
28	17.3	17.3	17.1
32	17.2	17.2	17.0
36	17.1	17.0	16.9
40	17.0	16.9	16.8
44	16.8	16.8	16.6
48	16.7	16.6	16.5
52	16.5	16.5	16.4
56	16.3	16.3	16.2
60	16.1	16.1	16.1
64	16.0	15.9	15.9
68	15.8	15.8	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	14.9	15.0	15.0
88	14.8	14.8	14.9
90			

Subtract from table, back cover

Hebrew New Year (Rosh Hashanah) 10

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
13 0	351 41.3	212 34.6	+16 11.6	200 13.8	+12 59.1	267 18.0	+22 45.6	147 18.2	− 7 41.8	134 50.1	131	−19 55.1	− 92
1	6 43.8	227 34.1	10.8	215 14.7	58.5	282 20.2	45.6	162 20.4	41.9	149 22.2	129	20 04.3	− 90
2	21 46.3	242 33.5	10.0	230 15.6	58.0	297 22.4	45.6	177 22.7	42.0	163 54.1	129	20 13.3	− 90
3	36 48.7	257 33.0	09.3	245 16.6	57.5	312 24.6	45.6	192 24.9	42.1	178 26.0	128	20 22.3	− 89
4	51 51.2	272 32.4	08.5	260 17.5	56.9	327 26.8	45.6	207 27.1	42.2	192 57.8	128	20 31.2	− 89
5	66 53.7	287 31.9	07.7	275 18.5	56.4	342 29.0	45.6	222 29.3	42.3	207 29.6	126	20 40.1	− 87
6	81 56.1	302 31.3	+16 06.9	290 19.4	+12 55.8	357 31.2	+22 45.6	237 31.5	− 7 42.4	222 01.2	126	−20 48.8	− 87
7	96 58.6	317 30.8	06.1	305 20.3	55.3	12 33.4	45.6	252 33.7	42.5	236 32.8	125	20 57.5	− 85
8	112 01.0	332 30.2	05.3	320 21.3	54.7	27 35.6	45.6	267 36.0	42.6	251 04.3	125	21 06.0	− 85
9	127 03.5	347 29.7	04.6	335 22.2	54.2	42 37.8	45.7	282 38.2	42.7	265 35.8	123	21 14.5	− 84
10	142 06.0	2 29.1	03.8	350 23.2	53.6	57 40.0	45.7	297 40.4	42.8	280 07.1	123	21 22.9	− 82
11	157 08.4	17 28.6	03.0	5 24.1	53.1	72 42.2	45.7	312 42.6	42.9	294 38.4	122	21 31.1	− 82
12	172 10.9	32 28.0	+16 02.2	20 25.1	+12 52.5	87 44.4	+22 45.7	327 44.8	− 7 43.0	309 09.6	121	−21 39.3	− 82
13	187 13.4	47 27.5	01.4	35 26.0	52.0	102 46.6	45.7	342 47.0	43.1	323 40.7	121	21 47.5	− 80
14	202 15.8	62 26.9	16 00.6	50 26.9	51.4	117 48.8	45.7	357 49.2	43.2	338 11.8	120	21 55.5	− 79
15	217 18.3	77 26.4	15 59.8	65 27.9	50.9	132 51.0	45.7	12 51.5	43.3	352 42.8	119	22 03.4	− 78
16	232 20.8	92 25.9	59.0	80 28.8	50.3	147 53.2	45.7	27 53.7	43.4	7 13.7	118	22 11.2	− 77
17	247 23.2	107 25.3	58.2	95 29.8	49.8	162 55.4	45.7	42 55.9	43.5	21 44.5	117	22 18.9	− 76
18	262 25.7	122 24.8	+15 57.4	110 30.7	+12 49.2	177 57.6	+22 45.7	57 58.1	− 7 43.6	36 15.2	117	−22 26.5	− 76
19	277 28.1	137 24.2	56.6	125 31.7	48.7	192 59.8	45.7	73 00.3	43.7	50 45.9	115	22 34.1	− 74
20	292 30.6	152 23.7	55.8	140 32.6	48.1	208 02.0	45.8	88 02.5	43.8	65 16.4	115	22 41.5	− 73
21	307 33.1	167 23.1	55.0	155 33.5	47.6	223 04.2	45.8	103 04.8	43.9	79 46.9	114	22 48.8	− 72
22	322 35.5	182 22.6	54.3	170 34.5	47.0	238 06.4	45.8	118 07.0	44.0	94 17.3	114	22 56.0	− 72
23	337 38.0	197 22.0	53.5	185 35.4	46.5	253 08.6	45.8	133 09.2	44.1	108 47.7	112	23 03.2	− 70
14 0	352 40.5	212 21.5	+15 52.7	200 36.4	+12 45.9	268 10.8	+22 45.8	148 11.4	− 7 44.2	123 17.9	112	−23 10.2	− 69
1	7 42.9	227 21.0	51.9	215 37.3	45.4	283 13.0	45.8	163 13.6	44.3	137 48.1	111	23 17.1	− 68
2	22 45.4	242 20.4	51.1	230 38.3	44.8	298 15.2	45.8	178 15.8	44.4	152 18.2	110	23 23.9	− 67
3	37 47.9	257 19.9	50.3	245 39.2	44.3	313 17.4	45.8	193 18.0	44.5	166 48.2	110	23 30.6	− 66
4	52 50.3	272 19.3	49.5	260 40.2	43.7	328 19.6	45.8	208 20.3	44.6	181 18.2	109	23 37.2	− 65
5	67 52.8	287 18.8	48.6	275 41.1	43.2	343 21.8	45.8	223 22.5	44.7	195 48.1	107	23 43.7	− 64
6	82 55.3	302 18.2	+15 47.8	290 42.0	+12 42.6	358 24.0	+22 45.8	238 24.7	− 7 44.8	210 17.8	108	−23 50.1	− 62
7	97 57.7	317 17.7	47.0	305 43.0	42.1	13 26.2	45.9	253 26.9	44.9	224 47.6	106	23 56.3	− 62
8	113 00.2	332 17.2	46.2	320 43.9	41.5	28 28.4	45.9	268 29.1	45.0	239 17.2	105	24 02.5	− 60
9	128 02.6	347 16.6	45.4	335 44.9	41.0	43 30.6	45.9	283 31.3	45.1	253 46.7	105	24 08.5	− 59
10	143 05.1	2 16.1	44.6	350 45.8	40.4	58 32.8	45.9	298 33.6	45.2	268 16.2	104	24 14.4	− 59
11	158 07.6	17 15.5	43.8	5 46.8	39.8	73 35.1	45.9	313 35.8	45.3	282 45.6	103	24 20.3	− 57
12	173 10.0	32 15.0	+15 43.0	20 47.7	+12 39.3	88 37.3	+22 45.9	328 38.0	− 7 45.4	297 14.9	103	−24 26.0	− 55
13	188 12.5	47 14.5	42.2	35 48.7	38.7	103 39.5	45.9	343 40.2	45.5	311 44.2	101	24 31.5	− 55
14	203 15.0	62 13.9	41.4	50 49.6	38.2	118 41.7	45.9	358 42.4	45.6	326 13.3	101	24 37.0	− 53
15	218 17.4	77 13.4	40.6	65 50.6	37.6	133 43.9	45.9	13 44.6	45.7	340 42.4	101	24 42.3	− 53
16	233 19.9	92 12.9	39.8	80 51.5	37.1	148 46.1	45.9	28 46.8	45.8	355 11.5	99	24 47.6	− 51
17	248 22.4	107 12.3	39.0	95 52.4	36.5	163 48.3	45.9	43 49.1	45.9	9 40.4	99	24 52.7	− 50
18	263 24.8	122 11.8	+15 38.1	110 53.4	+12 36.0	178 50.5	+22 46.0	58 51.3	− 7 46.0	24 09.3	98	−24 57.7	− 48
19	278 27.3	137 11.2	37.3	125 54.3	35.4	193 52.7	46.0	73 53.5	46.1	38 38.1	97	25 02.5	− 48
20	293 29.8	152 10.7	36.5	140 55.3	34.9	208 54.9	46.0	88 55.7	46.2	53 06.8	96	25 07.3	− 46
21	308 32.2	167 10.2	35.7	155 56.2	34.3	223 57.1	46.0	103 57.9	46.3	67 35.4	96	25 11.9	− 45
22	323 34.7	182 09.6	34.9	170 57.2	33.8	238 59.3	46.0	119 00.1	46.4	82 04.0	95	25 16.4	− 44
23	338 37.1	197 09.1	34.1	185 58.1	33.2	254 01.6	46.0	134 02.3	46.5	96 32.5	94	25 20.8	− 42
15 0	353 39.6	212 08.6	+15 33.2	200 59.1	+12 32.7	269 03.8	+22 46.0	149 04.5	− 7 46.6	111 00.9	94	−25 25.0	− 41
1	8 42.1	227 08.0	32.4	216 00.0	32.1	284 06.0	46.0	164 06.8	46.7	125 29.3	92	25 29.1	− 40
2	23 44.5	242 07.5	31.6	231 01.0	31.6	299 08.2	46.0	179 09.0	46.8	139 57.5	93	25 33.1	− 39
3	38 47.0	257 06.9	30.8	246 01.9	31.0	314 10.4	46.0	194 11.2	46.9	154 25.8	91	25 37.0	− 37
4	53 49.5	272 06.4	30.0	261 02.9	30.4	329 12.6	46.0	209 13.4	47.0	168 53.9	91	25 40.7	− 36
5	68 51.9	287 05.9	29.1	276 03.8	29.9	344 14.8	46.0	224 15.6	47.1	183 22.0	90	25 44.3	− 35
6	83 54.4	302 05.3	+15 28.3	291 04.8	+12 29.3	359 17.0	+22 46.1	239 17.8	− 7 47.2	197 50.0	89	−25 47.8	− 33
7	98 56.9	317 04.8	27.5	306 05.7	28.8	14 19.2	46.1	254 20.0	47.4	212 17.9	89	25 51.1	− 32
8	113 59.3	332 04.3	26.7	321 06.7	28.2	29 21.5	46.1	269 22.3	47.5	226 45.8	88	25 54.3	− 31
9	129 01.8	347 03.7	25.9	336 07.6	27.7	44 23.7	46.1	284 24.5	47.6	241 13.6	88	25 57.4	− 29
10	144 04.3	2 03.2	25.0	351 08.6	27.1	59 25.9	46.1	299 26.7	47.7	255 41.4	86	26 00.3	− 28
11	159 06.7	17 02.7	24.2	6 09.5	26.6	74 28.1	46.1	314 28.9	47.8	270 09.0	86	26 03.1	− 27
12	174 09.2	32 02.1	+15 23.4	21 10.5	+12 26.0	89 30.3	+22 46.1	329 31.1	− 7 47.9	284 36.6	86	−26 05.8	− 25
13	189 11.6	47 01.6	22.5	36 11.4	25.4	104 32.5	46.1	344 33.3	48.0	299 04.2	85	26 08.3	− 24
14	204 14.1	62 01.1	21.7	51 12.4	24.9	119 34.7	46.1	359 35.5	48.1	313 31.7	84	26 10.7	− 22
15	219 16.6	77 00.5	20.9	66 13.3	24.3	134 37.0	46.1	14 37.7	48.2	327 59.1	84	26 12.9	− 22
16	234 19.0	92 00.0	20.1	81 14.3	23.8	149 39.2	46.1	29 40.0	48.3	342 26.5	83	26 15.1	− 19
17	249 21.5	106 59.5	19.2	96 15.2	23.2	164 41.4	46.2	44 42.2	48.4	356 53.8	83	26 17.0	− 18
18	264 24.0	121 58.9	+15 18.4	111 16.2	+12 22.7	179 43.6	+22 46.2	59 44.4	− 7 48.5	11 21.1	82	−26 18.8	− 17
19	279 26.4	136 58.4	17.6	126 17.1	22.1	194 45.8	46.2	74 46.6	48.6	25 48.3	81	26 20.5	− 16
20	294 28.9	151 57.9	16.7	141 18.1	21.6	209 48.0	46.2	89 48.8	48.7	40 15.4	81	26 22.1	− 14
21	309 31.4	166 57.4	15.9	156 19.0	21.0	224 50.3	46.2	104 51.0	48.8	54 42.5	80	26 23.5	− 12
22	324 33.8	181 56.8	15.1	171 20.0	20.4	239 52.5	46.2	119 53.2	48.9	69 09.5	80	26 24.7	− 12
23	339 36.3	196 56.3	14.2	186 20.9	19.9	254 54.7	46.2	134 55.4	49.0	83 36.5	80	26 25.9	− 9
24	354 38.7	211 55.8	+15 13.4	201 21.9	+12 19.3	269 56.9	+22 46.2	149 57.6	− 7 49.1	98 03.5	78	−26 26.8	− 8
code	—	− 5	− 8	+ 10	− 6	+ 22	0	+ 22	− 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
13	0	180 57.9	+ 3 59.9
	1	195 58.1	58.9
	2	210 58.3	58.0
	3	225 58.5	57.0
	4	240 58.7	56.0
	5	255 59.0	55.1
	6	270 59.2	+ 3 54.1
	7	285 59.4	53.2
	8	300 59.6	52.2
	9	315 59.9	51.3
	10	331 00.1	50.3
	11	346 00.3	49.3
	12	1 00.5	+ 3 48.4
	13	16 00.7	47.4
	14	31 00.9	46.5
	15	46 01.2	45.5
	16	61 01.4	44.6
	17	76 01.6	43.6
	18	91 01.8	+ 3 42.6
	19	106 02.1	41.7
	20	121 02.3	40.7
	21	136 02.5	39.8
	22	151 02.7	38.8
	23	166 02.9	37.8
14	0	181 03.2	+ 3 36.9
	1	196 03.4	35.9
	2	211 03.6	35.0
	3	226 03.8	34.0
	4	241 04.0	33.1
	5	256 04.3	32.1
	6	271 04.5	+ 3 31.1
	7	286 04.7	30.2
	8	301 04.9	29.2
	9	316 05.1	28.3
	10	331 05.4	27.3
	11	346 05.6	26.3
	12	1 05.8	+ 3 25.4
	13	16 06.0	24.4
	14	31 06.2	23.5
	15	46 06.5	22.5
	16	61 06.7	21.5
	17	76 06.9	20.6
	18	91 07.1	+ 3 19.6
	19	106 07.4	18.7
	20	121 07.6	17.7
	21	136 07.8	16.7
	22	151 08.0	15.8
	23	166 08.2	14.8
15	0	181 08.5	+ 3 13.8
	1	196 08.7	12.9
	2	211 08.9	11.9
	3	226 09.1	11.0
	4	241 09.3	10.0
	5	256 09.6	09.0
	6	271 09.8	+ 3 08.1
	7	286 10.0	07.1
	8	301 10.2	06.2
	9	316 10.4	05.2
	10	331 10.7	04.2
	11	346 10.9	03.3
	12	1 11.1	+ 3 02.3
	13	16 11.3	01.3
	14	31 11.6	3 00.4
	15	46 11.8	+ 2 59.4
	16	61 12.0	58.5
	17	76 12.2	57.5
	18	91 12.4	+ 2 56.5
	19	106 12.7	55.6
	20	121 12.9	54.6
	21	136 13.1	53.6
	22	151 13.3	52.7
	23	166 13.6	51.7
	24	181 13.8	+ 2 50.8
code		—	− 10

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 52.0	−40 29.0
5	Achernar	335 59.3	−57 27.9
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 47.9	−28 54.2
10	Aldebaran	291 40.8	+16 25.2
32	Alioth	167 00.2	+56 12.7
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.9	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.6	−68 57.1
22	Avior	234 37.0	−59 21.3
13	Bellatrix	279 20.1	+ 6 18.8
16	Betelg'se	271 49.8	+ 7 24.2
17	Canopus	264 16.2	−52 39.8
12	Capella	281 40.7	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.1
27	Dubhe	194 46.9	+62 00.0
14	Elnath	279 09.3	+28 34.3
47	Eltanin	91 06.9	+51 29.9
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.4
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.3
6	Hamal	328 51.2	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.7
40	Kochab	137 18.3	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.7	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.4	−69 31.4
9	Mirfak	309 44.4	+49 41.9
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.2	−56 53.3
21	Pollux	244 22.6	+28 08.4
20	Procyon	245 46.8	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.1	− 8 14.9
38	Rigil Kent.	140 53.7	−60 39.1
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.4	+56 17.1
45	Shaula	97 22.8	−37 04.5
18	Sirius	259 13.3	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.9	−43 14.5
49	Vega	81 09.2	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT h	Equation of Time (App.—Mean) 13 m s	14 m s	15 m s
0	+ 3 51.0	+ 4 12.2	+ 4 33.4
6	+ 3 56.3	+ 4 17.5	+ 4 38.7
12	+ 4 01.6	+ 4 22.8	+ 4 44.0
18	+ 4 06.9	+ 4 28.1	+ 4 49.3
24	+ 4 12.2	+ 4 33.4	+ 4 54.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 13 h m	14 h m	15 h m	16 h m
72	5 02	////	▬	▬	▬	▬
70	5 07	////	▬	▬	▬	▬
68	5 12	0 37	▬	▬	▬	▬
66	5 16	1 36	13 47	▬	▬	▬
64	5 19	2 07	13 08	15 03	▬	▬
62	5 22	2 30	12 40	14 16	15 45	16 43
60	5 25	2 47	12 19	13 46	15 04	16 02
58	5 27	3 02	12 02	13 23	14 37	15 34
56	5 29	3 13	11 48	13 05	14 15	15 13
54	5 31	3 23	11 36	12 49	13 57	14 55
52	5 32	3 32	11 25	12 36	13 42	14 39
50	5 34	3 39	11 15	12 24	13 29	14 26
45	5 37	3 55	10 55	12 00	13 02	13 59
40	5 40	4 07	10 38	11 41	12 41	13 37
35	5 42	4 15	10 25	11 24	12 23	13 20
30	5 44	4 22	10 13	11 10	12 08	13 04
20	5 47	4 33	9 52	10 47	11 43	12 38
10	5 50	4 40	9 35	10 27	11 20	12 16
0	5 52	4 44	9 19	10 08	11 00	11 55
10	5 55	4 45	9 02	9 49	10 39	11 34
20	5 57	4 45	8 45	9 29	10 17	11 12
30	6 00	4 42	8 25	9 06	9 52	10 46
35	6 01	4 39	8 14	8 52	9 37	10 30
40	6 03	4 35	8 01	8 37	9 20	10 12
45	6 05	4 29	7 45	8 18	8 59	9 51
50	6 07	4 21	7 26	7 55	8 33	9 24
52	6 08	4 17	7 17	7 44	8 21	9 11
54	6 09	4 13	7 07	7 32	8 06	8 56
56	6 10	4 08	6 56	7 18	7 50	8 38
58	6 12	4 01	6 43	7 01	7 30	8 16
60	6 13	3 55	6 28	6 41	7 04	7 49

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 13 h m	14 h m	15 h m	16 h m
72	18 47	////	▬	▬	▬	▬
70	18 42	////	▬	▬	▬	▬
68	18 37	22 55	▬	▬	▬	▬
66	18 33	22 06	17 02	▬	▬	▬
64	18 30	21 37	17 42	17 30	▬	▬
62	18 27	21 15	18 10	18 17	18 39	19 36
60	18 25	20 59	18 31	18 48	19 19	20 17
58	18 23	20 45	18 49	19 11	19 47	20 44
56	18 21	20 34	19 04	19 29	20 09	21 06
54	18 19	20 24	19 17	19 45	20 26	21 24
52	18 18	20 16	19 28	19 59	20 42	21 39
50	18 16	20 08	19 38	20 11	20 55	21 52
45	18 13	19 54	19 59	20 36	21 22	22 19
40	18 11	19 43	20 17	20 56	21 44	22 40
35	18 09	19 35	20 31	21 13	22 01	22 58
30	18 07	19 27	20 44	21 27	22 17	23 13
20	18 04	19 18	21 05	21 51	22 43	23 39
10	18 01	19 11	21 24	22 13	23 05	24 01
0	17 59	19 08	21 42	22 32	23 26	24 22
10	17 57	19 07	22 00	22 52	23 47	24 42
20	17 54	19 07	22 19	23 14	24 09	0 09
30	17 52	19 12	22 41	23 38	24 35	0 35
35	17 50	19 14	22 53	23 53	24 51	0 51
40	17 49	19 19	23 08	24 10	0 10	1 08
45	17 47	19 25	23 26	24 30	0 30	1 30
50	17 45	19 33	23 48	24 55	0 55	1 57
52	17 44	19 37	23 59	25 08	1 08	2 10
54	17 43	19 42	24 11	0 11	1 22	2 25
56	17 42	19 47	24 25	0 25	1 39	2 43
58	17 41	19 54	24 41	0 41	1 58	3 04
60	17 39	20 01	25 00	1 00	2 23	3 32

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
13	15 30	9 50	10 38	6 10	14 09
14	16 20	9 51	10 37	6 06	14 05
15	17 13	9 52	10 35	6 03	14 02
16	18 08	9 53	10 34	5 59	13 58

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	13 ′	14 ′	15 ′
0	12.6	13.3	14.2
4	12.6	13.3	14.2
8	12.7	13.3	14.2
12	12.7	13.3	14.2
16	12.7	13.3	14.2
20	12.8	13.4	14.2
24	12.9	13.4	14.3
28	12.9	13.5	14.3
32	13.0	13.6	14.3
36	13.1	13.6	14.4
40	13.2	13.7	14.4
44	13.3	13.8	14.5
48	13.4	13.9	14.5
52	13.6	14.0	14.6
56	13.7	14.1	14.7
60	13.8	14.2	14.7
64	14.0	14.3	14.8
68	14.1	14.4	14.9
72	14.3	14.6	14.9
76	14.4	14.7	15.0
80	14.6	14.8	15.1
84	14.8	14.9	15.2
88	14.9	15.0	15.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	13 ′	14 ′	15 ′
0	17.2	16.9	16.4
4	17.2	16.8	16.3
8	17.2	16.8	16.3
12	17.2	16.8	16.3
16	17.1	16.8	16.3
20	17.1	16.7	16.3
24	17.0	16.7	16.2
28	16.9	16.6	16.2
32	16.8	16.6	16.2
36	16.7	16.5	16.1
40	16.6	16.4	16.1
44	16.5	16.3	16.0
48	16.4	16.2	16.0
52	16.3	16.1	15.9
56	16.1	16.0	15.8
60	16.0	15.9	15.8
64	15.9	15.8	15.7
68	15.7	15.7	15.6
72	15.6	15.6	15.6
76	15.4	15.4	15.5
80	15.2	15.3	15.4
84	15.1	15.2	15.3
88	15.0	15.1	15.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −1.9 GHA	Dec.	SATURN 1.0 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
16 h 0	354 38.7	211 55.8	+15 13.4	201 21.9	+12 19.3	269 56.9	+22 46.2	149 57.6	− 7 49.1	98 03.5	78	−26 26.8	− 8
1	9 41.2	226 55.2	12.6	216 22.8	18.8	284 59.1	46.2	164 59.9	49.2	112 30.3	79	26 27.6	− 7
2	24 43.7	241 54.7	11.7	231 23.8	18.2	300 01.3	46.2	180 02.1	49.3	126 57.2	78	26 28.3	− 5
3	39 46.1	256 54.2	•• 10.9	246 24.7	•• 17.7	315 03.6	•• 46.2	195 04.3	•• 49.4	141 24.0	77	•26 28.8	− 4
4	54 48.6	271 53.7	10.0	261 25.7	17.1	330 05.8	46.2	210 06.5	49.5	155 50.7	77	26 29.2	− 3
5	69 51.1	286 53.1	09.2	276 26.6	16.5	345 08.0	46.3	225 08.7	49.6	170 17.4	76	26 29.5	0
6	84 53.5	301 52.6	+15 08.4	291 27.6	+12 16.0	0 10.2	+22 46.3	240 10.9	− 7 49.7	184 44.0	76	−26 29.5	0
7	99 56.0	316 52.1	07.5	306 28.5	15.4	15 12.4	46.3	255 13.1	49.8	199 10.6	76	26 29.5	+ 2
8	114 58.5	331 51.5	06.7	321 29.5	14.9	30 14.7	46.3	270 15.3	49.9	213 37.2	75	26 29.3	+ 4
9	130 00.9	346 51.0	•• 05.8	336 30.4	•• 14.3	45 16.9	•• 46.3	285 17.5	•• 50.0	228 03.7	75	•26 28.9	+ 5
10	145 03.4	1 50.5	05.0	351 31.4	13.8	60 19.1	46.3	300 19.8	50.1	242 30.2	75	26 28.4	+ 7
11	160 05.9	16 50.0	04.1	6 32.3	13.2	75 21.3	46.3	315 22.0	50.2	256 56.7	74	26 27.7	+ 8
12	175 08.3	31 49.4	+15 03.3	21 33.3	+12 12.6	90 23.6	+22 46.3	330 24.2	− 7 50.3	271 23.1	74	−26 26.9	+ 10
13	190 10.8	46 48.9	02.5	36 34.2	12.1	105 25.8	46.3	345 26.4	50.4	285 49.5	73	26 25.9	+ 11
14	205 13.2	61 48.4	01.6	51 35.2	11.5	120 28.0	46.3	0 28.6	50.5	300 15.8	73	26 24.8	+ 13
15	220 15.7	76 47.9	•15 00.8	66 36.1	•• 11.0	135 30.2	•• 46.3	15 30.8	•• 50.6	314 42.1	73	•26 23.5	+ 14
16	235 18.2	91 47.3	14 59.9	81 37.1	10.4	150 32.4	46.3	30 33.0	50.7	329 08.4	72	26 22.1	+ 16
17	250 20.6	106 46.8	59.1	96 38.0	09.9	165 34.7	46.3	45 35.2	50.8	343 34.6	72	26 20.5	+ 17
18	265 23.1	121 46.3	+14 58.2	111 39.0	+12 09.3	180 36.9	+22 46.4	60 37.4	− 7 50.9	358 00.8	72	−26 18.8	+ 19
19	280 25.6	136 45.8	57.4	126 39.9	08.7	195 39.1	46.4	75 39.7	51.0	12 27.0	72	26 16.9	+ 20
20	295 28.0	151 45.2	56.5	141 40.9	08.2	210 41.3	46.4	90 41.9	51.1	26 53.2	71	26 14.9	+ 22
21	310 30.5	166 44.7	•• 55.7	156 41.8	•• 07.6	225 43.6	•• 46.4	105 44.1	•• 51.2	41 19.3	71	•26 12.7	+ 24
22	325 33.0	181 44.2	54.8	171 42.8	07.1	240 45.8	46.4	120 46.3	51.3	55 45.4	71	26 10.3	+ 25
23	340 35.4	196 43.7	54.0	186 43.8	06.5	255 48.0	46.4	135 48.5	51.5	70 11.5	71	26 07.8	+ 27
17 0	355 37.9	211 43.1	+14 53.1	201 44.7	+12 05.9	270 50.2	+22 46.4	150 50.7	− 7 51.6	84 37.6	71	−26 05.1	+ 28
1	10 40.4	226 42.6	52.2	216 45.7	05.4	285 52.5	46.4	165 52.9	51.7	99 03.7	70	26 02.3	+ 30
2	25 42.8	241 42.1	51.4	231 46.6	04.8	300 54.7	46.4	180 55.1	51.8	113 29.7	70	25 59.3	+ 31
3	40 45.3	256 41.6	•• 50.5	246 47.6	•• 04.3	315 56.9	•• 46.4	195 57.3	•• 51.9	127 55.7	70	•25 56.2	+ 33
4	55 47.7	271 41.1	49.7	261 48.5	03.7	330 59.1	46.4	210 59.5	52.0	142 21.7	70	25 52.9	+ 34
5	70 50.2	286 40.5	48.8	276 49.5	03.1	346 01.4	46.4	226 01.8	52.1	156 47.7	70	25 49.5	+ 36
6	85 52.7	301 40.0	+14 48.0	291 50.4	+12 02.6	1 03.6	+22 46.5	241 04.0	− 7 52.2	171 13.7	69	−25 45.9	+ 38
7	100 55.1	316 39.5	47.1	306 51.4	02.0	16 05.8	46.5	256 06.2	52.3	185 39.6	70	25 42.1	+ 39
8	115 57.6	331 39.0	46.2	321 52.3	01.5	31 08.1	46.5	271 08.4	52.4	200 05.6	69	25 38.2	+ 41
9	131 00.1	346 38.5	•• 45.4	336 53.3	•• 00.9	46 10.3	•• 46.5	286 10.6	•• 52.5	214 31.5	69	•25 34.1	+ 42
10	146 02.5	1 37.9	44.5	351 54.2	12 00.3	61 12.5	46.5	301 12.8	52.6	228 57.4	70	25 29.9	+ 44
11	161 05.0	16 37.4	43.7	6 55.2	11 59.8	76 14.7	46.5	316 15.0	52.7	243 23.4	69	25 25.5	+ 45
12	176 07.5	31 36.9	+14 42.8	21 56.2	+11 59.2	91 17.0	+22 46.5	331 17.2	− 7 52.8	257 49.3	69	−25 21.0	+ 47
13	191 09.9	46 36.4	41.9	36 57.1	58.7	106 19.2	46.5	346 19.4	52.9	272 15.2	69	25 16.3	+ 49
14	206 12.4	61 35.9	41.1	51 58.1	58.1	121 21.4	46.5	1 21.6	53.0	286 41.1	69	25 11.4	+ 50
15	221 14.9	76 35.3	•• 40.2	66 59.0	•• 57.5	136 23.7	•• 46.5	16 23.9	•• 53.1	301 07.0	70	•25 06.4	+ 52
16	236 17.3	91 34.8	39.3	82 00.0	57.0	151 25.9	46.5	31 26.1	53.2	315 33.0	69	25 01.2	+ 53
17	251 19.8	106 34.3	38.5	97 00.9	56.4	166 28.1	46.5	46 28.3	53.3	329 58.9	69	24 55.9	+ 55
18	266 22.2	121 33.8	+14 37.6	112 01.9	+11 55.9	181 30.4	+22 46.5	61 30.5	− 7 53.4	344 24.8	69	−24 50.4	+ 56
19	281 24.7	136 33.3	36.7	127 02.8	55.3	196 32.6	46.6	76 32.7	53.5	358 50.7	69	24 44.8	+ 58
20	296 27.2	151 32.8	35.9	142 03.8	54.7	211 34.8	46.6	91 34.9	53.6	13 16.6	70	24 39.0	+ 60
21	311 29.6	166 32.2	•• 35.0	157 04.8	•• 54.2	226 37.0	•• 46.6	106 37.1	•• 53.7	27 42.6	69	•24 33.0	+ 61
22	326 32.1	181 31.7	34.1	172 05.7	53.6	241 39.3	46.6	121 39.3	53.8	42 08.5	70	24 26.9	+ 62
23	341 34.6	196 31.2	33.3	187 06.7	53.0	256 41.5	46.6	136 41.5	53.9	56 34.5	69	24 20.7	+ 64
18 0	356 37.0	211 30.7	+14 32.4	202 07.6	+11 52.5	271 43.7	+22 46.6	151 43.7	− 7 54.0	71 00.4	70	−24 14.3	+ 66
1	11 39.5	226 30.2	31.5	217 08.6	51.9	286 46.0	46.6	166 45.9	54.1	85 26.4	70	24 07.7	+ 67
2	26 42.0	241 29.7	30.6	232 09.5	51.4	301 48.2	46.6	181 48.1	54.2	99 52.4	69	24 01.0	+ 69
3	41 44.4	256 29.2	•• 29.8	247 10.5	•• 50.8	316 50.4	•• 46.6	196 50.4	•• 54.3	114 18.3	70	•23 54.1	+ 70
4	56 46.9	271 28.6	28.9	262 11.5	50.2	331 52.7	46.6	211 52.6	54.4	128 44.3	71	23 47.1	+ 72
5	71 49.3	286 28.1	28.0	277 12.4	49.7	346 54.9	46.6	226 54.8	54.5	143 10.4	70	23 39.9	+ 73
6	86 51.8	301 27.6	+14 27.1	292 13.4	+11 49.1	1 57.2	+22 46.6	241 57.0	− 7 54.6	157 36.4	70	−23 32.6	+ 75
7	101 54.3	316 27.1	26.3	307 14.3	48.5	16 59.4	46.6	256 59.2	54.8	172 02.4	71	23 25.1	+ 76
8	116 56.7	331 26.6	25.4	322 15.3	48.0	32 01.6	46.6	272 01.4	54.9	186 28.5	71	23 17.5	+ 78
9	131 59.2	346 26.1	•• 24.5	337 16.2	•• 47.4	47 03.9	•• 46.7	287 03.6	•• 55.0	200 54.6	71	•23 09.7	+ 80
10	147 01.7	1 25.6	23.6	352 17.2	46.9	62 06.1	46.7	302 05.8	55.1	215 20.7	71	23 01.7	+ 80
11	162 04.1	16 25.0	22.7	7 18.2	46.3	77 08.3	46.7	317 08.0	55.2	229 46.8	72	22 53.7	+ 83
12	177 06.6	31 24.5	+14 21.9	22 19.1	+11 45.7	92 10.6	+22 46.7	332 10.2	− 7 55.3	244 13.0	71	−22 45.4	+ 84
13	192 09.1	46 24.0	21.0	37 20.1	45.2	107 12.8	46.7	347 12.4	55.4	258 39.1	72	22 37.0	+ 85
14	207 11.5	61 23.5	20.1	52 21.0	44.6	122 15.0	46.7	2 14.6	55.5	273 05.3	72	22 28.5	+ 87
15	222 14.0	76 23.0	•• 19.2	67 22.0	•• 44.0	137 17.3	•• 46.7	17 16.8	•• 55.6	287 31.5	73	•22 19.8	+ 88
16	237 16.5	91 22.5	18.3	82 23.0	43.5	152 19.5	46.7	32 19.1	55.7	301 57.8	72	22 11.0	+ 90
17	252 18.9	106 22.0	17.5	97 23.9	42.9	167 21.8	46.7	47 21.3	55.8	316 24.0	73	22 02.0	+ 91
18	267 21.4	121 21.5	+14 16.6	112 24.9	+11 42.3	182 24.0	+22 46.7	62 23.5	− 7 55.9	330 50.3	73	−21 52.9	+ 92
19	282 23.8	136 21.0	15.7	127 25.8	41.8	197 26.2	46.7	77 25.7	56.0	345 16.6	74	21 43.7	+ 94
20	297 26.3	151 20.4	14.8	142 26.8	41.2	212 28.5	46.7	92 27.9	56.1	359 43.0	73	21 34.3	+ 96
21	312 28.8	166 19.9	•• 13.9	157 27.8	•• 40.7	227 30.7	•• 46.7	107 30.1	•• 56.2	14 09.3	74	•21 24.7	+ 97
22	327 31.2	181 19.4	13.0	172 28.7	40.1	242 33.0	46.8	122 32.3	56.3	28 35.7	75	21 15.0	+ 98
23	342 33.7	196 18.9	12.1	187 29.7	39.5	257 35.2	46.8	137 34.5	56.4	43 02.2	74	21 05.2	+100
24	357 36.2	211 18.4	+14 11.2	202 30.6	+11 39.0	272 37.4	+22 46.8	152 36.7	− 7 56.5	57 28.6	75	−20 55.2	+101
code	−	− 5	− 9	+ 9	− 5	+ 22	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
16 0	181 13.8	+ 2 50.8
1	196 14.0	49.8
2	211 14.2	48.8
3	226 14.4	•• 47.9
4	241 14.7	46.9
5	256 14.9	45.9
6	271 15.1	+ 2 45.0
7	286 15.3	44.0
8	301 15.6	43.0
9	316 15.8	•• 42.1
10	331 16.0	41.1
11	346 16.2	40.1
12	1 16.4	+ 2 39.2
13	16 16.7	38.2
14	31 16.9	37.2
15	46 17.1	•• 36.3
16	61 17.3	35.3
17	76 17.5	34.4
18	91 17.8	+ 2 33.4
19	106 18.0	32.4
20	121 18.2	31.5
21	136 18.4	•• 30.5
22	151 18.7	29.5
23	166 18.9	28.6
17 0	181 19.1	+ 2 27.6
1	196 19.3	26.6
2	211 19.6	25.7
3	226 19.8	•• 24.7
4	241 20.0	23.7
5	256 20.2	22.8
6	271 20.4	+ 2 21.8
7	286 20.7	20.8
8	301 20.9	19.9
9	316 21.1	•• 18.9
10	331 21.3	17.9
11	346 21.6	17.0
12	1 21.8	+ 2 16.0
13	16 22.0	15.0
14	31 22.2	14.1
15	46 22.4	•• 13.1
16	61 22.7	12.1
17	76 22.9	11.2
18	91 23.1	+ 2 10.2
19	106 23.3	09.2
20	121 23.6	08.3
21	136 23.8	•• 07.3
22	151 24.0	06.3
23	166 24.2	05.4
18 0	181 24.4	+ 2 04.4
1	196 24.7	03.4
2	211 24.9	02.5
3	226 25.1	•• 01.5
4	241 25.3	2 00.5
5	256 25.6	1 59.6
6	271 25.8	+ 1 58.6
7	286 26.0	57.6
8	301 26.2	56.7
9	316 26.4	•• 55.7
10	331 26.7	54.7
11	346 26.9	53.8
12	1 27.1	+ 1 52.8
13	16 27.3	51.8
14	31 27.6	50.8
15	46 27.8	•• 49.9
16	61 28.0	48.9
17	76 28.2	47.9
18	91 28.4	+ 1 47.0
19	106 28.7	46.0
20	121 28.9	45.0
21	136 29.1	•• 44.1
22	151 29.3	43.1
23	166 29.6	42.1
24	181 29.8	+ 1 41.2
code	—	+ 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.9	−40 29.0
5	Achernar	335 59.3	−57 27.9
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 47.9	−28 54.2
10	Aldebaran	291 40.7	+16 25.2
32	Alioth	167 00.3	+56 12.7
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.8	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.6	−68 57.1
22	Avior	234 36.9	−59 21.3
13	Bellatrix	279 20.1	+ 6 18.8
16	Betelg'se	271 49.8	+ 7 24.2
17	Canopus	264 16.2	−52 39.8
12	Capella	281 40.7	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.9	+62 00.0
14	Elnath	279 09.3	+28 34.3
47	Eltanin	91 06.9	+51 29.9
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.3
6	Hamal	328 51.1	+23 14.8
48	Kaus Aust.	84 43.1	−34 24.7
40	Kochab	137 18.3	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.7	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.3	−69 31.4
9	Mirfak	309 44.4	+49 41.9
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.2	−56 53.3
21	Pollux	244 22.6	+28 08.4
20	Procyon	245 46.7	+ 5 20.8
46	R'alhague	96 48.0	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.1	− 8 14.9
38	Rigil Kent.	140 53.7	−60 39.0
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.3	+56 17.1
45	Shaula	97 22.8	−37 04.5
18	Sirius	259 13.3	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.9	−43 14.5
49	Vega	81 09.2	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 16	17	18
h	m s	m s	m s
0	+ 4 54.7	+ 5 16.0	+ 5 37.3
6	+ 5 00.0	+ 5 21.3	+ 5 42.7
12	+ 5 05.3	+ 5 26.7	+ 5 48.0
18	+ 5 10.6	+ 5 32.0	+ 5 53.3
24	+ 5 16.0	+ 5 37.3	+ 5 58.7

Lat.	Sunrise	Twlt. begins	Moonrise 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	5 15	////	▬	▬	▬	19 48
70	5 19	////	▬	▬	▬	18 53
68	5 22	1 18	▬	▬	19 28	18 18
66	5 25	1 57	▬	▬	18 17	17 53
64	5 28	2 23	▬	17 53	17 41	17 34
62	5 30	2 42	16 43	17 06	17 15	17 18
60	5 32	2 57	16 02	16 36	16 54	17 04
58	5 33	3 10	15 34	16 13	16 37	16 53
56	5 35	3 21	15 13	15 54	16 23	16 42
54	5 36	3 30	14 55	15 39	16 10	16 33
52	5 37	3 39	14 39	15 25	15 59	16 25
50	5 38	3 45	14 26	15 13	15 49	16 18
45	5 41	3 59	13 59	14 48	15 29	16 02
40	5 42	4 10	13 37	14 28	15 12	15 49
35	5 44	4 18	13 20	14 11	14 58	15 38
30	5 45	4 25	13 04	13 57	14 45	15 29
20	5 48	4 34	12 38	13 32	14 24	15 12
10	5 50	4 40	12 16	13 11	14 05	14 57
0	5 51	4 43	11 55	12 51	13 48	14 43
10	5 53	4 43	11 34	12 31	13 30	14 30
20	5 54	4 42	11 12	12 10	13 12	14 15
30	5 56	4 37	10 46	11 45	12 50	13 58
35	5 57	4 34	10 30	11 31	12 37	13 48
40	5 58	4 30	10 12	11 14	12 23	13 36
45	5 59	4 23	9 51	10 54	12 05	13 23
50	6 00	4 14	9 24	10 28	11 43	13 06
52	6 01	4 09	9 11	10 16	11 33	12 58
54	6 02	4 05	8 56	10 02	11 21	12 50
56	6 02	3 59	8 38	9 45	11 08	12 40
58	6 03	3 52	8 16	9 25	10 52	12 29
60	6 04	3 44	7 49	9 00	10 33	12 15
S						

Lat.	Sunset	Twlt. ends	Moonset 16	17	18	19
N °	h m	h m	h m	h m	h m	h m
72	18 32	////	▬	▬	▬	22 28
70	18 28	////	▬	▬	▬	23 23
68	18 25	22 20	▬	▬	20 49	23 55
66	18 22	21 44	▬	▬	21 59	24 19
64	18 20	21 20	▬	20 25	22 34	24 37
62	18 18	21 01	19 36	21 11	23 00	24 52
60	18 16	20 46	20 17	21 41	23 20	25 05
58	18 14	20 34	20 44	22 03	23 36	25 15
56	18 13	20 24	21 06	22 22	23 50	25 25
54	18 12	20 15	21 24	22 37	24 02	0 02
52	18 11	20 08	21 39	22 50	24 12	0 12
50	18 10	20 01	21 52	23 02	24 22	0 22
45	18 08	19 48	22 19	23 26	24 41	0 41
40	18 06	19 38	22 40	23 46	24 57	0 57
35	18 05	19 30	22 58	24 02	0 02	1 10
30	18 03	19 23	23 13	24 16	0 16	1 22
20	18 01	19 14	23 39	24 39	0 39	1 42
10	17 59	19 09	24 01	0 01	1 00	1 59
0	17 58	19 07	24 22	0 22	1 18	2 14
10	17 56	19 06	24 42	0 42	1 37	2 30
20	17 55	19 08	0 09	1 04	1 57	2 47
30	17 53	19 13	0 35	1 30	2 20	3 06
35	17 53	19 17	0 51	1 45	2 33	3 17
40	17 52	19 22	1 08	2 02	2 49	3 29
45	17 51	19 29	1 30	2 23	3 07	3 44
50	17 50	19 39	1 57	2 49	3 30	4 02
52	17 49	19 43	2 10	3 01	3 41	4 11
54	17 48	19 48	2 25	3 16	3 53	4 20
56	17 48	19 54	2 43	3 32	4 07	4 30
58	17 47	20 01	3 04	3 52	4 23	4 42
60	17 47	20 10	3 32	4 18	4 43	4 56
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
16	18 08	9 53	10 34	5 59	13 58
17	19 05	9 54	10 32	5 56	13 55
18	20 01	9 54	10 31	5 52	13 51
19	20 56	9 55	10 29	5 49	13 48

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.2	0.1	0.1
30	0.2	0.1	0.0
45	0.2	0.1	0.0
60	0.2	0.0	0.0
75	0.2	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	16	17	18
°	′	′	′
0	15.2	16.3	17.5
4	15.2	16.3	17.5
8	15.2	16.3	17.4
12	15.2	16.3	17.4
16	15.2	16.3	17.4
20	15.2	16.3	17.4
24	15.2	16.3	17.3
28	15.2	16.2	17.3
32	15.2	16.2	17.2
36	15.2	16.2	17.1
40	15.2	16.2	17.1
44	15.3	16.1	17.0
48	15.3	16.1	16.9
52	15.3	16.1	16.8
56	15.3	16.0	16.8
60	15.3	16.0	16.7
64	15.3	16.0	16.6
68	15.4	15.9	16.5
72	15.4	15.9	16.4
76	15.4	15.8	16.3
80	15.4	15.8	16.2
84	15.4	15.8	16.1
88	15.5	15.7	16.0
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	16	17	18
°	′	′	′
0	15.8	15.1	14.5
4	15.8	15.1	14.5
8	15.8	15.1	14.5
12	15.8	15.1	14.5
16	15.8	15.1	14.5
20	15.7	15.2	14.6
24	15.7	15.2	14.6
28	15.7	15.2	14.7
32	15.7	15.2	14.7
36	15.7	15.2	14.8
40	15.7	15.3	14.8
44	15.7	15.3	14.9
48	15.7	15.3	15.0
52	15.6	15.4	15.1
56	15.6	15.4	15.2
60	15.6	15.4	15.3
64	15.6	15.5	15.3
68	15.6	15.5	15.4
72	15.6	15.5	15.5
76	15.5	15.6	15.6
80	15.5	15.6	15.8
84	15.5	15.7	15.9
88	15.5	15.7	15.9
90			

Subtract from table, back cover

First Quarter 16

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
19 h 0	357 36.2	211 18.4	+14 11.2	202 30.6	+11 39.0	272 37.4	+22 46.8	152 36.7	− 7 56.5	57 28.6	75	−20 55.2	+101
1	12 38.6	226 17.9	10.4	217 31.6	38.4	287 39.7	46.8	167 38.9	56.6	71 55.1	75	20 45.1	+102
2	27 41.1	241 17.4	09.5	232 32.6	37.8	302 41.9	46.8	182 41.1	56.7	86 21.6	75	20 34.9	+104
3	42 43.6	256 16.9	08.6	247 33.5	37.3	317 44.2	46.8	197 43.3	56.8	100 48.1	76	20 24.5	+105
4	57 46.0	271 16.4	07.7	262 34.5	36.7	332 46.4	46.8	212 45.5	56.9	115 14.7	76	20 14.0	+107
5	72 48.5	286 15.9	06.8	277 35.4	36.1	347 48.6	46.8	227 47.7	57.0	129 41.3	77	20 03.3	+108
6	87 51.0	301 15.4	+14 05.9	292 36.4	+11 35.6	2 50.9	+22 46.8	242 50.0	− 7 57.1	144 08.0	76	−19 52.5	+109
7	102 53.4	316 14.9	05.0	307 37.4	35.0	17 53.1	46.8	257 52.2	57.2	158 34.6	77	19 41.6	+111
8	117 55.9	331 14.3	04.1	322 38.3	34.4	32 55.4	46.8	272 54.4	57.3	173 01.3	78	19 30.5	+112
9	132 58.3	346 13.8	03.2	337 39.3	33.9	47 57.6	46.8	287 56.6	57.4	187 28.1	77	19 19.3	+113
10	148 00.8	1 13.3	02.3	352 40.2	33.3	62 59.9	46.8	302 58.8	57.5	201 54.8	78	19 08.0	+115
11	163 03.3	16 12.8	01.4	7 41.2	32.7	78 02.1	46.8	318 01.0	57.7	216 21.6	79	18 56.5	+115
12	178 05.7	31 12.3	+14 00.5	22 42.2	+11 32.2	93 04.4	+22 46.9	333 03.2	− 7 57.8	230 48.5	78	−18 45.0	+118
13	193 08.2	46 11.8	13 59.6	37 43.1	31.6	108 06.6	46.9	348 05.4	57.9	245 15.3	79	18 33.2	+118
14	208 10.7	61 11.3	58.7	52 44.1	31.0	123 08.8	46.9	3 07.6	58.0	259 42.2	80	18 21.4	+120
15	223 13.1	76 10.8	57.8	67 45.0	30.5	138 11.1	46.9	18 09.8	58.1	274 09.2	79	18 09.4	+120
16	238 15.6	91 10.3	56.9	82 46.0	29.9	153 13.3	46.9	33 12.0	58.2	288 36.1	80	17 57.4	+123
17	253 18.1	106 09.8	56.0	97 47.0	29.3	168 15.6	46.9	48 14.2	58.3	303 03.1	81	17 45.1	+123
18	268 20.5	121 09.3	+13 55.1	112 47.9	+11 28.8	183 17.8	+22 46.9	63 16.4	− 7 58.4	317 30.2	81	−17 32.8	+124
19	283 23.0	136 08.8	54.2	127 48.9	28.2	198 20.1	46.9	78 18.6	58.5	331 57.3	81	17 20.4	+126
20	298 25.4	151 08.3	53.3	142 49.8	27.6	213 22.3	46.9	93 20.8	58.6	346 24.4	81	17 07.8	+127
21	313 27.9	166 07.8	52.4	157 50.8	27.1	228 24.6	46.9	108 23.0	58.7	0 51.5	82	−16 55.1	+128
22	328 30.4	181 07.3	51.5	172 51.8	26.5	243 26.8	46.9	123 25.2	58.8	15 18.7	82	16 42.3	+129
23	343 32.8	196 06.8	50.6	187 52.7	25.9	258 29.1	46.9	138 27.5	58.9	29 45.9	82	16 29.4	+131
20 0	358 35.3	211 06.3	+13 49.7	202 53.7	+11 25.4	273 31.3	+22 46.9	153 29.7	− 7 59.0	44 13.1	83	−16 16.3	+131
1	13 37.8	226 05.8	48.8	217 54.7	24.8	288 33.6	46.9	168 31.9	59.1	58 40.4	83	16 03.2	+133
2	28 40.2	241 05.3	47.9	232 55.6	24.2	303 35.8	46.9	183 34.1	59.2	73 07.7	83	15 49.9	+134
3	43 42.7	256 04.8	47.0	247 56.6	23.7	318 38.1	47.0	198 36.3	59.3	87 35.0	84	15 36.5	+135
4	58 45.2	271 04.3	46.1	262 57.5	23.1	333 40.3	47.0	213 38.5	59.4	102 02.4	84	15 23.0	+136
5	73 47.6	286 03.8	45.2	277 58.5	22.5	348 42.6	47.0	228 40.7	59.5	116 29.8	85	15 09.4	+137
6	88 50.1	301 03.3	+13 44.3	292 59.5	+11 22.0	3 44.8	+22 47.0	243 42.9	− 7 59.6	130 57.3	84	−14 55.7	+138
7	103 52.6	316 02.8	43.3	308 00.4	21.4	18 47.1	47.0	258 45.1	59.7	145 24.7	85	14 41.9	+139
8	118 55.0	331 02.3	42.4	323 01.4	20.8	33 49.3	47.0	273 47.3	59.8	159 52.2	86	14 28.0	+140
9	133 57.5	346 01.8	41.5	338 02.4	20.3	48 51.6	47.0	288 49.5	− 7 59.9	174 19.8	86	14 14.0	+141
10	148 59.9	1 01.3	40.6	353 03.3	19.7	63 53.8	47.0	303 51.7	8 00.0	188 47.4	86	13 59.9	+142
11	164 02.4	16 00.8	39.7	8 04.3	19.1	78 56.1	47.0	318 53.9	00.1	203 15.0	86	13 45.7	+143
12	179 04.9	31 00.3	+13 38.8	23 05.3	+11 18.6	93 58.3	+22 47.0	333 56.1	− 8 00.2	217 42.6	86	−13 31.4	+144
13	194 07.3	45 59.8	37.9	38 06.2	18.0	109 00.6	47.0	348 58.3	00.4	232 10.2	87	13 17.0	+145
14	209 09.8	60 59.3	36.9	53 07.2	17.4	124 02.8	47.0	4 00.5	00.5	246 37.9	88	13 02.5	+146
15	224 12.3	75 58.8	36.0	68 08.2	16.8	139 05.1	47.0	19 02.7	00.6	261 05.7	87	12 47.9	+147
16	239 14.7	90 58.3	35.1	83 09.1	16.3	154 07.3	47.0	34 04.9	00.7	275 33.4	88	12 33.2	+148
17	254 17.2	105 57.8	34.2	98 10.1	15.7	169 09.6	47.0	49 07.1	00.8	290 01.2	88	12 18.4	+148
18	269 19.7	120 57.3	+13 33.3	113 11.0	+11 15.1	184 11.8	+22 47.1	64 09.3	− 8 00.9	304 29.0	88	−12 03.6	+150
19	284 22.1	135 56.8	32.4	128 12.0	14.6	199 14.1	47.1	79 11.5	01.0	318 56.8	89	11 48.6	+150
20	299 24.6	150 56.3	31.4	143 13.0	14.0	214 16.3	47.1	94 13.7	01.1	333 24.7	88	11 33.6	+151
21	314 27.1	165 55.8	30.5	158 13.9	13.4	229 18.6	47.1	109 16.0	01.2	347 52.5	90	11 18.5	+152
22	329 29.5	180 55.3	29.6	173 14.9	12.9	244 20.9	47.1	124 18.2	01.3	2 20.5	89	11 03.3	+153
23	344 32.0	195 54.8	28.7	188 15.9	12.3	259 23.1	47.1	139 20.4	01.4	16 48.4	89	10 48.0	+154
21 0	359 34.4	210 54.3	+13 27.8	203 16.8	+11 11.7	274 25.4	+22 47.1	154 22.6	− 8 01.5	31 16.3	90	−10 32.6	+154
1	14 36.9	225 53.8	26.8	218 17.8	11.1	289 27.6	47.1	169 24.8	01.6	45 44.3	90	10 17.2	+155
2	29 39.4	240 53.3	25.9	233 18.8	10.6	304 29.9	47.1	184 27.0	01.7	60 12.3	91	10 01.7	+156
3	44 41.8	255 52.8	25.0	248 19.7	10.0	319 32.1	47.1	199 29.2	01.8	74 40.4	90	9 46.1	+157
4	59 44.3	270 52.3	24.1	263 20.7	09.4	334 34.4	47.1	214 31.4	01.9	89 08.4	91	9 30.4	+157
5	74 46.8	285 51.8	23.1	278 21.7	08.9	349 36.7	47.1	229 33.6	02.0	103 36.5	91	9 14.7	+158
6	89 49.2	300 51.4	+13 22.2	293 22.6	+11 08.3	4 38.9	+22 47.1	244 35.8	− 8 02.1	118 04.6	91	− 8 58.9	+159
7	104 51.7	315 50.9	21.3	308 23.6	07.7	19 41.2	47.1	259 38.0	02.2	132 32.7	91	8 43.0	+159
8	119 54.2	330 50.4	20.3	323 24.6	07.2	34 43.4	47.1	274 40.2	02.3	147 00.8	91	8 27.1	+160
9	134 56.6	345 49.9	19.4	338 25.5	06.6	49 45.7	47.2	289 42.4	02.4	161 28.9	92	8 11.1	+160
10	149 59.1	0 49.4	18.5	353 26.5	06.0	64 48.0	47.2	304 44.6	02.5	175 57.1	92	7 55.1	+162
11	165 01.5	15 48.9	17.6	8 27.5	05.4	79 50.2	47.2	319 46.8	02.6	190 25.3	92	7 38.9	+161
12	180 04.0	30 48.4	+13 16.6	23 28.4	+11 04.9	94 52.5	+22 47.2	334 49.0	− 8 02.8	204 53.5	92	− 7 22.8	+163
13	195 06.5	45 47.9	15.7	38 29.4	04.3	109 54.7	47.2	349 51.2	02.9	219 21.7	92	7 06.5	+162
14	210 08.9	60 47.4	14.8	53 30.4	03.7	124 57.0	47.2	4 53.4	03.0	233 49.9	92	6 50.3	+164
15	225 11.4	75 46.9	13.8	68 31.3	03.2	139 59.3	47.2	19 55.6	03.1	248 18.1	93	6 33.9	+164
16	240 13.9	90 46.4	12.9	83 32.3	02.6	155 01.5	47.2	34 57.8	03.2	262 46.4	92	6 17.5	+164
17	255 16.3	105 45.9	12.0	98 33.3	02.0	170 03.8	47.2	50 00.0	03.3	277 14.6	93	6 01.1	+165
18	270 18.8	120 45.4	+13 11.0	113 34.2	+11 01.4	185 06.0	+22 47.2	65 02.2	− 8 03.4	291 42.9	93	− 5 44.6	+165
19	285 21.3	135 45.0	10.1	128 35.2	00.9	200 08.3	47.2	80 04.4	03.5	306 11.2	92	5 28.1	+166
20	300 23.7	150 44.5	09.2	143 36.2	11 00.3	215 10.6	47.2	95 06.6	03.6	320 39.4	93	5 11.5	+166
21	315 26.2	165 44.0	08.2	158 37.1	·10 59.7	230 12.8	47.2	110 08.8	03.7	335 07.7	93	4 54.9	+166
22	330 28.7	180 43.5	07.3	173 38.1	59.2	245 15.1	47.2	125 11.0	03.8	349 36.0	93	4 38.3	+167
23	345 31.1	195 43.0	06.4	188 39.1	58.6	260 17.4	47.2	140 13.2	03.9	4 04.3	94	4 21.6	+167
24	0 33.6	210 42.5	+13 05.4	203 40.0	+10 58.0	275 19.6	+22 47.2	155 15.4	− 8 04.0	18 32.7	93	− 4 04.9	+168
code	—	− 5	− 9	+ 9	− 6	+ 23	0	+ 22	− 2				

GMT	SUN GHA	SUN Dec.
19 h 0	181 29.8	+ 1 41.2
1	196 30.0	40.2
2	211 30.2	39.2
3	226 30.4	38.3
4	241 30.7	37.3
5	256 30.9	36.3
6	271 31.1	+ 1 35.3
7	286 31.3	34.4
8	301 31.6	33.4
9	316 31.8	32.4
10	331 32.0	31.5
11	346 32.2	30.5
12	1 32.4	+ 1 29.5
13	16 32.7	28.6
14	31 32.9	27.6
15	46 33.1	26.6
16	61 33.3	25.6
17	76 33.6	24.7
18	91 33.8	+ 1 23.7
19	106 34.0	22.7
20	121 34.2	21.8
21	136 34.4	20.8
22	151 34.7	19.8
23	166 34.9	18.9
20 0	181 35.1	+ 1 17.9
1	196 35.3	16.9
2	211 35.6	15.9
3	226 35.8	15.0
4	241 36.0	14.0
5	256 36.2	13.0
6	271 36.4	+ 1 12.1
7	286 36.7	11.1
8	301 36.9	10.1
9	316 37.1	09.1
10	331 37.3	08.2
11	346 37.6	07.2
12	1 37.8	+ 1 06.2
13	16 38.0	05.3
14	31 38.2	04.3
15	46 38.4	03.3
16	61 38.7	02.4
17	76 38.9	01.4
18	91 39.1	+ 1 00.4
19	106 39.3	0 59.4
20	121 39.5	58.5
21	136 39.8	57.5
22	151 40.0	56.5
23	166 40.2	55.6
21 0	181 40.4	+ 0 54.6
1	196 40.7	53.6
2	211 40.9	52.6
3	226 41.1	51.7
4	241 41.3	50.7
5	256 41.5	49.7
6	271 41.8	+ 0 48.7
7	286 42.0	47.8
8	301 42.2	46.8
9	316 42.4	45.8
10	331 42.6	44.9
11	346 42.9	43.9
12	1 43.1	+ 0 42.9
13	16 43.3	41.9
14	31 43.5	41.0
15	46 43.8	40.0
16	61 44.0	39.0
17	76 44.2	38.1
18	91 44.4	+ 0 37.1
19	106 44.6	36.1
20	121 44.9	35.1
21	136 45.1	34.2
22	151 45.3	33.2
23	166 45.5	32.2
24	181 45.7	+ 0 31.3
code	—	- 9

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.9	−40 29.0
5	Achernar	335 59.3	−57 28.0
30	Acrux	174 00.4	−62 50.7
19	Adhara	255 47.9	−28 54.1
10	Aldebaran	291 40.7	+16 25.2
32	Alioth	167 00.3	+56 12.7
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.3	−47 11.1
15	Alnilam	276 31.8	− 1 13.6
25	Alphard	218 40.4	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.7	−68 57.1
22	Avior	234 36.9	−59 21.3
13	Bellatrix	279 20.0	+ 6 18.8
16	Betelg'se	271 49.8	+ 7 24.2
17	Canopus	264 16.1	−52 39.8
12	Capella	281 40.6	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.9	+62 00.0
14	Elnath	279 09.2	+28 34.3
47	Eltanin	91 06.9	+51 29.9
54	Enif	34 30.8	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.1	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.4	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.7	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.3	−69 31.4
9	Mirfak	309 44.4	+49 41.9
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.2	−56 53.3
21	Pollux	244 22.6	+28 08.4
20	Procyon	245 46.7	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.1	− 8 14.9
38	Rigil Kent.	140 53.7	−60 39.0
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.3	+56 17.2
45	Shaula	97 22.8	−37 04.5
18	Sirius	259 13.3	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.9	−43 14.5
49	Vega	81 09.2	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

Lat. N°	Sunrise h m	Twlt. begins h m	Moonrise 19 h m	20 h m	21 h m	22 h m
72	5 28	////	19 48	18 28	17 48	17 15
70	5 31	0 53	18 53	18 08	17 40	17 16
68	5 33	1 44	18 18	17 52	17 33	17 17
66	5 35	2 16	17 53	17 39	17 28	17 17
64	5 36	2 37	17 34	17 28	17 23	17 18
62	5 38	2 54	17 18	17 18	17 18	17 18
60	5 39	3 07	17 04	17 10	17 15	17 18
58	5 40	3 20	16 53	17 03	17 11	17 19
56	5 41	3 29	16 42	16 57	17 09	17 19
54	5 41	3 38	16 33	16 51	17 06	17 19
52	5 42	3 44	16 25	16 46	17 03	17 20
50	5 43	3 50	16 18	16 41	17 01	17 20
45	5 44	4 04	16 02	16 31	16 56	17 20
40	5 45	4 13	15 49	16 22	16 52	17 21
35	5 46	4 21	15 38	16 15	16 49	17 21
30	5 47	4 26	15 29	16 08	16 46	17 22
20	5 48	4 35	15 12	15 57	16 40	17 22
10	5 49	4 39	14 57	15 47	16 35	17 23
0	5 50	4 42	14 43	15 38	16 31	17 23
10	5 51	4 42	14 30	15 28	16 26	17 24
20	5 52	4 40	14 15	15 18	16 21	17 25
30	5 53	4 34	13 58	15 07	16 16	17 25
35	5 53	4 30	13 48	15 00	16 13	17 26
40	5 53	4 24	13 36	14 52	16 09	17 26
45	5 54	4 17	13 23	14 43	16 05	17 27
50	5 54	4 07	13 06	14 32	16 00	17 28
52	5 54	4 02	12 58	14 27	15 58	17 28
54	5 55	3 57	12 50	14 22	15 55	17 29
56	5 55	3 50	12 40	14 16	15 52	17 29
58	5 55	3 42	12 29	14 08	15 49	17 30
60	5 55	3 34	12 15	14 00	15 45	17 30

Lat. N°	Sunset h m	Twlt. ends h m	Moonset 19 h m	20 h m	21 h m	22 h m
72	18 16	////	22 28	25 43	1 43	4 17
70	18 14	22 38	23 23	26 01	2 01	4 21
68	18 12	21 53	23 55	26 15	2 15	4 25
66	18 10	21 24	24 19	0 19	2 26	4 28
64	18 09	21 04	24 37	0 37	2 35	4 31
62	18 08	20 48	24 52	0 52	2 43	4 33
60	18 07	20 35	25 05	1 05	2 50	4 35
58	18 06	20 24	25 15	1 15	2 56	4 36
56	18 05	20 14	25 25	1 25	3 01	4 38
54	18 04	20 06	0 02	1 33	3 06	4 39
52	18 04	20 00	0 12	1 40	3 10	4 40
50	18 03	19 53	0 22	1 47	3 14	4 41
45	18 02	19 41	0 41	2 01	3 22	4 44
40	18 01	19 32	0 57	2 12	3 29	4 46
35	18 00	19 25	1 10	2 22	3 34	4 47
30	18 00	19 20	1 22	2 30	3 40	4 49
20	17 58	19 11	1 42	2 45	3 48	4 51
10	17 58	19 08	1 59	2 58	3 56	4 54
0	17 57	19 06	2 14	3 09	4 03	4 56
10	17 56	19 06	2 30	3 21	4 10	4 57
20	17 56	19 09	2 47	3 33	4 17	5 00
30	17 55	19 15	3 06	3 47	4 25	5 02
35	17 55	19 19	3 17	3 55	4 30	5 03
40	17 54	19 25	3 29	4 04	4 36	5 05
45	17 54	19 33	3 44	4 15	4 42	5 06
50	17 54	19 43	4 02	4 28	4 49	5 08
52	17 54	19 49	4 11	4 34	4 52	5 09
54	17 54	19 55	4 20	4 40	4 56	5 10
56	17 53	20 00	4 30	4 47	5 00	5 11
58	17 53	20 08	4 42	4 55	5 05	5 12
60	17 53	20 18	4 56	5 04	5 10	5 13

GMT h	Equation of Time (App.—Mean) 19 m s	20 m s	21 m s
0	+ 5 58.7	+ 6 20.0	+ 6 41.3
6	+ 6 04.0	+ 6 25.3	+ 6 46.6
12	+ 6 09.3	+ 6 30.7	+ 6 51.9
18	+ 6 14.7	+ 6 36.0	+ 6 57.2
24	+ 6 20.0	+ 6 41.3	+ 7 02.5

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
19	20 56	9 55	10 29	5 49	13 48
20	21 50	9 56	10 28	5 45	13 44
21	22 43	9 57	10 26	5 41	13 41
22	23 36	9 58	10 25	5 38	13 37

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	19 ′	20 ′	21 ′
0	18.7	19.7	20.6
4	18.7	19.7	20.6
8	18.7	19.7	20.6
12	18.7	19.7	20.5
16	18.6	19.6	20.4
20	18.6	19.5	20.4
24	18.5	19.4	20.2
28	18.4	19.3	20.1
32	18.3	19.2	20.0
36	18.2	19.1	19.8
40	18.1	18.9	19.6
44	18.0	18.7	19.4
48	17.8	18.6	19.2
52	17.7	18.4	19.0
56	17.6	18.2	18.8
60	17.4	18.0	18.5
64	17.2	17.8	18.3
68	17.1	17.6	18.0
72	16.9	17.4	17.7
76	16.8	17.1	17.5
80	16.6	16.9	17.2
84	16.4	16.7	16.9
88	16.3	16.5	16.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	19 ′	20 ′	21 ′
0	13.7	13.2	12.6
4	13.7	13.2	12.7
8	13.8	13.2	12.7
12	13.8	13.2	12.8
16	13.9	13.3	12.8
20	13.9	13.4	12.9
24	14.0	13.5	13.0
28	14.1	13.6	13.2
32	14.2	13.7	13.3
36	14.3	13.8	13.5
40	14.4	14.0	13.7
44	14.5	14.2	13.9
48	14.6	14.3	14.1
52	14.8	14.5	14.3
56	14.9	14.7	14.5
60	15.1	14.9	14.8
64	15.2	15.1	15.0
68	15.4	15.3	15.3
72	15.5	15.5	15.5
76	15.7	15.8	15.8
80	15.9	16.0	16.1
84	16.1	16.2	16.4
88	16.2	16.4	16.6
90			

Subtract from table, back cover

Day of Atonement (Yom Kippur) 19

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
22 0	0 33.6	210 42.5	+13 05.4	203 40.0	+10 58.0	275 19.6	+22 47.2	155 15.4	− 8 04.0	18 32.7	93	− 4 04.9	+168
1	15 36.0	225 42.0	04.5	218 41.0	57.4	290 21.9	47.2	170 17.6	04.1	33 01.0	93	3 48.1	+168
2	30 38.5	240 41.5	03.5	233 42.0	56.9	305 24.2	47.3	185 19.8	04.2	47 29.3	93	3 31.3	+168
3	45 41.0	255 41.0	·· 02.6	248 42.9	·· 56.3	320 26.4	·· 47.3	200 22.0	·· 04.3	61 57.6	93	· 3 14.5	+168
4	60 43.4	270 40.6	01.7	263 43.9	55.7	335 28.7	47.3	215 24.2	04.4	76 25.9	93	2 57.7	+169
5	75 45.9	285 40.1	13 00.7	278 44.9	55.1	350 30.9	47.3	230 26.4	04.5	90 54.2	94	2 40.8	+169
6	90 48.4	300 39.6	+12 59.8	293 45.9	+10 54.6	5 33.2	+22 47.3	245 28.7	− 8 04.6	105 22.6	93	− 2 23.9	+169
7	105 50.8	315 39.1	58.8	308 46.8	54.0	20 35.5	47.3	260 30.9	04.7	119 50.9	93	2 07.0	+169
8	120 53.3	330 38.6	57.9	323 47.8	53.4	35 37.7	47.3	275 33.1	04.8	134 19.2	93	1 50.1	+170
9	135 55.8	345 38.1	·· 56.9	338 48.8	·· 52.9	50 40.0	·· 47.3	290 35.3	·· 04.9	148 47.5	93	· 1 33.1	+169
10	150 58.2	0 37.6	56.0	353 49.7	52.3	65 42.3	47.3	305 37.5	05.1	163 15.8	93	1 16.2	+170
11	166 00.7	15 37.2	55.0	8 50.7	51.7	80 44.6	47.3	320 39.7	05.2	177 44.1	93	0 59.2	+170
12	181 03.1	30 36.7	+12 54.1	23 51.7	+10 51.1	95 46.8	+22 47.3	335 41.9	− 8 05.3	192 12.4	93	− 0 42.2	+170
13	196 05.6	45 36.2	53.2	38 52.6	50.6	110 49.1	47.3	350 44.1	05.4	206 40.7	92	0 25.2	+170
14	211 08.1	60 35.7	52.2	53 53.6	50.0	125 51.4	47.3	5 46.3	05.5	221 08.9	93	− 0 08.2	+170
15	226 10.5	75 35.2	·· 51.3	68 54.6	·· 49.4	140 53.6	·· 47.3	20 48.5	·· 05.6	235 37.2	93	+ 0 08.8	+171
16	241 13.0	90 34.7	50.3	83 55.5	48.8	155 55.9	47.3	35 50.7	05.7	250 05.5	92	0 25.9	+170
17	256 15.5	105 34.2	49.4	98 56.5	48.3	170 58.2	47.3	50 52.9	05.8	264 33.7	92	0 42.9	+170
18	271 17.9	120 33.8	+12 48.4	113 57.5	+10 47.7	186 00.4	+22 47.4	65 55.1	− 8 05.9	279 01.9	93	+ 0 59.9	+170
19	286 20.4	135 33.3	47.5	128 58.5	47.1	201 02.7	47.4	80 57.3	06.0	293 30.2	92	1 16.9	+170
20	301 22.9	150 32.8	46.5	143 59.4	46.5	216 05.0	47.4	95 59.5	06.1	307 58.4	92	1 33.9	+170
21	316 25.3	165 32.3	·· 45.6	159 00.4	·· 46.0	231 07.2	·· 47.4	111 01.7	·· 06.2	322 26.6	91	· 1 50.9	+170
22	331 27.8	180 31.8	44.6	174 01.4	45.4	246 09.5	47.4	126 03.9	06.3	336 54.7	92	2 07.9	+170
23	346 30.3	195 31.3	43.6	189 02.3	44.8	261 11.8	47.4	141 06.1	06.4	351 22.9	91	2 24.9	+170
23 0	1 32.7	210 30.9	+12 42.7	204 03.3	+10 44.2	276 14.1	+22 47.4	156 08.3	− 8 06.5	5 51.0	91	+ 2 41.9	+169
1	16 35.2	225 30.4	41.7	219 04.3	43.7	291 16.3	47.4	171 10.5	06.6	20 19.1	91	2 58.8	+170
2	31 37.6	240 29.9	40.8	234 05.3	43.1	306 18.6	47.4	186 12.7	06.7	34 47.2	91	3 15.8	+169
3	46 40.1	255 29.4	·· 39.8	249 06.2	·· 42.5	321 20.9	·· 47.4	201 14.9	·· 06.8	49 15.3	91	· 3 32.7	+169
4	61 42.6	270 28.9	38.9	264 07.2	41.9	336 23.2	47.4	216 17.1	06.9	63 43.4	90	3 49.6	+169
5	76 45.0	285 28.5	37.9	279 08.2	41.4	351 25.4	47.4	231 19.3	07.0	78 11.4	90	4 06.5	+168
6	91 47.5	300 28.0	+12 37.0	294 09.1	+10 40.8	6 27.7	+22 47.4	246 21.5	− 8 07.2	92 39.4	90	+ 4 23.3	+169
7	106 50.0	315 27.5	36.0	309 10.1	40.2	21 30.0	47.4	261 23.7	07.3	107 07.4	89	4 40.2	+167
8	121 52.4	330 27.0	35.0	324 11.1	39.6	36 32.2	47.4	276 25.9	07.4	121 35.3	90	4 56.9	+168
9	136 54.9	345 26.5	·· 34.1	339 12.1	·· 39.1	51 34.5	·· 47.4	291 28.1	·· 07.5	136 03.3	89	· 5 13.7	+167
10	151 57.4	0 26.1	33.1	354 13.0	38.5	66 36.8	47.4	306 30.3	07.6	150 31.2	88	5 30.4	+167
11	166 59.8	15 25.6	32.2	9 14.0	37.9	81 39.1	47.4	321 32.5	07.7	164 59.0	89	5 47.1	+167
12	182 02.3	30 25.1	+12 31.2	24 15.0	+10 37.3	96 41.3	+22 47.5	336 34.7	− 8 07.8	179 26.9	88	+ 6 03.8	+166
13	197 04.7	45 24.6	30.2	39 15.9	36.8	111 43.6	47.5	351 36.9	07.9	193 54.7	88	6 20.4	+166
14	212 07.2	60 24.1	29.3	54 16.9	36.2	126 45.9	47.5	6 39.1	08.0	208 22.5	87	6 37.0	+165
15	227 09.7	75 23.7	·· 28.3	69 17.9	·· 35.6	141 48.2	·· 47.5	21 41.3	·· 08.1	222 50.2	87	· 6 53.5	+165
16	242 12.1	90 23.2	27.3	84 18.9	35.0	156 50.5	47.5	36 43.5	08.2	237 17.9	87	7 10.0	+164
17	257 14.6	105 22.7	26.4	99 19.8	34.5	171 52.7	47.5	51 45.7	08.3	251 45.6	87	7 26.4	+164
18	272 17.1	120 22.2	+12 25.4	114 20.8	+10 33.9	186 55.0	+22 47.5	66 47.9	− 8 08.4	266 13.3	86	+ 7 42.8	+164
19	287 19.5	135 21.8	24.4	129 21.8	33.3	201 57.3	47.5	81 50.1	08.5	280 40.9	86	7 59.2	+163
20	302 22.0	150 21.3	23.5	144 22.8	32.7	216 59.6	47.5	96 52.3	08.6	295 08.5	85	8 15.5	+162
21	317 24.5	165 20.8	·· 22.5	159 23.7	·· 32.1	232 01.8	·· 47.5	111 54.5	·· 08.7	309 36.0	85	· 8 31.7	+161
22	332 26.9	180 20.3	21.5	174 24.7	31.6	247 04.1	47.5	126 56.7	08.8	324 03.5	85	8 47.8	+162
23	347 29.4	195 19.9	20.6	189 25.7	31.0	262 06.4	47.5	141 58.9	08.9	338 31.0	84	9 04.0	+160
24 0	2 31.9	210 19.4	+12 19.6	204 26.6	+10 30.4	277 08.7	+22 47.5	157 01.1	− 8 09.0	352 58.4	84	+ 9 20.0	+160
1	17 34.3	225 18.9	18.6	219 27.6	29.8	292 11.0	47.5	172 03.3	09.1	7 25.8	83	9 36.0	+159
2	32 36.8	240 18.4	17.7	234 28.6	29.3	307 13.2	47.5	187 05.5	09.3	21 53.1	83	9 51.9	+158
3	47 39.2	255 18.0	·· 16.7	249 29.6	·· 28.7	322 15.5	·· 47.5	202 07.7	·· 09.4	36 20.4	83	·10 07.7	+158
4	62 41.7	270 17.5	15.7	264 30.5	28.1	337 17.8	47.5	217 09.9	09.5	50 47.7	82	10 23.5	+157
5	77 44.2	285 17.0	14.7	279 31.5	27.5	352 20.1	47.5	232 12.1	09.6	65 14.9	82	10 39.2	+157
6	92 46.6	300 16.5	+12 13.8	294 32.5	+10 26.9	7 22.4	+22 47.6	247 14.3	− 8 09.7	79 42.1	81	+10 54.9	+155
7	107 49.1	315 16.1	12.8	309 33.5	26.4	22 24.7	47.6	262 16.5	09.8	94 09.2	81	11 10.4	+155
8	122 51.6	330 15.6	11.8	324 34.4	25.8	37 26.9	47.6	277 18.7	09.9	108 36.3	81	11 25.9	+154
9	137 54.0	345 15.1	·· 10.8	339 35.4	·· 25.2	52 29.2	·· 47.6	292 20.9	·· 10.0	123 03.4	80	·11 41.3	+153
10	152 56.5	0 14.6	09.9	354 36.4	24.6	67 31.5	47.6	307 23.1	10.1	137 30.4	79	11 56.6	+153
11	167 59.0	15 14.2	08.9	9 37.4	24.1	82 33.8	47.6	322 25.3	10.2	151 57.3	79	12 11.9	+151
12	183 01.4	30 13.7	+12 07.9	24 38.3	+10 23.5	97 36.1	+22 47.6	337 27.5	− 8 10.3	166 24.2	79	+12 27.0	+151
13	198 03.9	45 13.2	06.9	39 39.3	22.9	112 38.4	47.6	352 29.7	10.4	180 51.1	78	12 42.1	+149
14	213 06.4	60 12.7	06.0	54 40.3	22.3	127 40.6	47.6	7 31.9	10.5	195 17.9	78	12 57.0	+149
15	228 08.8	75 12.3	·· 05.0	69 41.3	·· 21.7	142 42.9	·· 47.6	22 34.1	·· 10.6	209 44.7	77	·13 11.9	+148
16	243 11.3	90 11.8	04.0	84 42.2	21.2	157 45.2	47.6	37 36.3	10.7	224 11.4	77	13 26.7	+147
17	258 13.7	105 11.3	03.0	99 43.2	20.6	172 47.5	47.6	52 38.5	10.8	238 38.1	76	13 41.4	+146
18	273 16.2	120 10.9	+12 02.0	114 44.2	+10 20.0	187 49.8	+22 47.6	67 40.7	− 8 10.9	253 04.7	76	+13 56.0	+145
19	288 18.7	135 10.4	01.1	129 45.2	19.4	202 52.1	47.6	82 42.9	11.0	267 31.3	75	14 10.5	+144
20	303 21.1	150 09.9	12 00.1	144 46.1	18.8	217 54.4	47.6	97 45.1	11.1	281 57.8	75	14 24.9	+143
21	318 23.6	165 09.4	·11 59.1	159 47.1	·· 18.3	232 56.6	·· 47.6	112 47.3	·· 11.3	296 24.3	74	·14 39.2	+142
22	333 26.1	180 09.0	58.1	174 48.1	17.7	247 58.9	47.6	127 49.5	11.4	310 50.7	74	14 53.4	+141
23	348 28.5	195 08.5	57.1	189 49.1	17.1	263 01.2	47.6	142 51.7	11.5	325 17.1	73	15 07.5	+139
24	3 31.0	210 08.0	+11 56.1	204 50.0	+10 16.5	278 03.5	+22 47.6	157 53.9	− 8 11.6	339 43.4	73	+15 21.4	+139
code	—	− 5	− 10	+ 9	− 5	+ 23	0	+ 22	− 1				

GMT h	SUN GHA ° ′	SUN Dec. ° ′
22 0	181 45.7	+ 0 31.3
1	196 46.0	30.3
2	211 46.2	29.3
3	226 46.4	28.3
4	241 46.6	27.4
5	256 46.8	26.4
6	271 47.1	+ 0 25.4
7	286 47.3	24.4
8	301 47.5	23.5
9	316 47.7	22.5
10	331 48.0	21.5
11	346 48.2	20.5
12	1 48.4	+ 0 19.6
13	16 48.6	18.6
14	31 48.8	17.6
15	46 49.0	16.7
16	61 49.3	15.7
17	76 49.5	14.7
18	91 49.7	+ 0 13.7
19	106 49.9	12.8
20	121 50.2	11.8
21	136 50.4	10.8
22	151 50.6	09.8
23	166 50.8	08.9
23 0	181 51.0	+ 0 07.9
1	196 51.2	06.9
2	211 51.5	06.0
3	226 51.7	05.0
4	241 51.9	04.0
5	256 52.1	03.0
6	271 52.3	+ 0 02.1
7	286 52.6	01.1
8	301 52.8	+ 0 00.1
9	316 53.0	− 0 00.9
10	331 53.2	01.8
11	346 53.4	02.8
12	1 53.7	− 0 03.8
13	16 53.9	04.8
14	31 54.1	05.7
15	46 54.3	06.7
16	61 54.5	07.7
17	76 54.8	08.7
18	91 55.0	− 0 09.6
19	106 55.2	10.6
20	121 55.4	11.6
21	136 55.6	12.5
22	151 55.8	13.5
23	166 56.1	14.5
24 0	181 56.3	− 0 15.5
1	196 56.5	16.4
2	211 56.7	17.4
3	226 56.9	18.4
4	241 57.2	19.4
5	256 57.4	20.3
6	271 57.6	− 0 21.3
7	286 57.8	22.3
8	301 58.0	23.3
9	316 58.2	24.2
10	331 58.5	25.2
11	346 58.7	26.2
12	1 58.9	− 0 27.2
13	16 59.1	28.1
14	31 59.3	29.1
15	46 59.6	30.1
16	61 59.8	31.1
17	77 00.0	32.0
18	92 00.2	− 0 33.0
19	107 00.4	34.0
20	122 00.6	34.9
21	137 00.9	35.9
22	152 01.1	36.9
23	167 01.3	37.9
24	182 01.5	− 0 38.8
code	—	− 10

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.9	−40 29.0
5	Achernar	335 59.3	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.8	−28 54.1
10	Aldebaran	291 40.7	+16 25.2
32	Alioth	167 00.3	+56 12.7
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.4	−47 11.1
15	Alnilam	276 31.8	− 1 13.6
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.7	−68 57.1
22	Avior	234 36.9	−59 21.3
13	Bellatrix	279 20.0	+ 6 18.8
16	Betelg'se	271 49.8	+ 7 24.2
17	Canopus	264 16.1	−52 39.8
12	Capella	281 40.6	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.9	+62 00.0
14	Elnath	279 09.2	+28 34.3
47	Eltanin	91 07.0	+51 29.9
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.1	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.4	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.7	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.3	−69 31.3
9	Mirfak	309 44.3	+49 41.9
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.3	−56 53.3
21	Pollux	244 22.6	+28 08.4
20	Procyon	245 46.7	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.0	− 8 14.9
38	Rigil Kent.	140 53.7	−60 39.0
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.3	+56 17.2
45	Shaula	97 22.8	−37 04.5
18	Sirius	259 13.2	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.8	−43 14.5
49	Vega	81 09.3	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 22 h m	23 h m	24 h m	25 h m
72	5 42	////	17 15	16 41	15 57	▭
70	5 43	1 29	17 16	16 51	16 21	15 27
68	5 44	2 06	17 17	17 00	16 40	16 10
66	5 44	2 31	17 17	17 07	16 55	16 40
64	5 45	2 50	17 18	17 13	17 08	17 02
62	5 45	3 05	17 18	17 18	17 18	17 20
60	5 46	3 17	17 18	17 22	17 27	17 35
58	5 46	3 28	17 19	17 26	17 36	17 48
56	5 47	3 37	17 19	17 30	17 43	17 59
54	5 47	3 44	17 19	17 33	17 49	18 09
52	5 47	3 50	17 20	17 36	17 55	18 18
50	5 47	3 56	17 20	17 39	18 00	18 26
45	5 48	4 08	17 20	17 45	18 12	18 43
40	5 48	4 16	17 21	17 50	18 21	18 57
35	5 48	4 23	17 21	17 54	18 29	19 08
30	5 49	4 28	17 22	17 58	18 37	19 19
20	5 49	4 36	17 22	18 05	18 49	19 37
10	5 49	4 39	17 23	18 11	19 00	19 53
0	5 49	4 41	17 23	18 16	19 11	20 08
10	5 49	4 40	17 24	18 22	19 22	20 23
20	5 49	4 37	17 25	18 28	19 33	20 39
30	5 49	4 30	17 25	18 36	19 47	20 58
35	5 48	4 25	17 26	18 40	19 54	21 09
40	5 48	4 19	17 26	18 45	20 03	21 21
45	5 48	4 11	17 27	18 50	20 14	21 36
50	5 47	4 00	17 28	18 57	20 26	21 55
52	5 47	3 54	17 28	19 00	20 32	22 04
54	5 47	3 48	17 29	19 03	20 39	22 14
56	5 47	3 41	17 29	19 07	20 46	22 25
58	5 46	3 33	17 30	19 11	20 54	22 38
60	5 46	3 23	17 30	19 16	21 04	22 53
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 22 h m	23 h m	24 h m	25 h m
72	18 01	23 12	4 17	6 46	9 26	▭
70	18 00	22 04	4 21	6 40	9 04	11 56
68	17 59	21 30	4 25	6 34	8 48	11 15
66	17 59	21 07	4 28	6 30	8 34	10 47
64	17 58	20 48	4 31	6 26	8 24	10 26
62	17 58	20 35	4 33	6 23	8 14	10 09
60	17 58	20 23	4 35	6 20	8 06	9 55
58	17 57	20 13	4 36	6 17	7 59	9 43
56	17 57	20 05	4 38	6 15	7 53	9 33
54	17 57	19 58	4 39	6 13	7 48	9 24
52	17 57	19 52	4 40	6 11	7 43	9 16
50	17 57	19 47	4 41	6 10	7 39	9 08
45	17 56	19 35	4 44	6 06	7 29	8 53
40	17 56	19 27	4 46	6 03	7 22	8 40
35	17 56	19 21	4 47	6 01	7 15	8 30
30	17 56	19 16	4 49	5 59	7 09	8 20
20	17 56	19 09	4 51	5 55	6 59	8 04
10	17 56	19 06	4 54	5 51	6 50	7 51
0	17 56	19 05	4 56	5 48	6 42	7 38
10	17 56	19 06	4 57	5 45	6 34	7 25
20	17 56	19 09	5 00	5 42	6 25	7 11
30	17 57	19 17	5 02	5 38	6 15	6 55
35	17 57	19 22	5 03	5 36	6 09	6 46
40	17 57	19 28	5 05	5 33	6 03	6 36
45	17 58	19 37	5 06	5 30	5 56	6 24
50	17 58	19 48	5 08	5 27	5 47	6 10
52	17 59	19 54	5 09	5 25	5 43	6 03
54	17 59	20 01	5 10	5 23	5 38	5 56
56	17 59	20 08	5 11	5 22	5 33	5 47
58	18 00	20 17	5 12	5 19	5 28	5 38
60	18 00	20 27	5 13	5 17	5 21	5 27
S						

GMT h	Equation of Time (App.—Mean) 22 m s	23 m s	24 m s
0	+ 7 02.5	+ 7 23.7	+ 7 44.7
6	+ 7 07.8	+ 7 28.9	+ 7 49.9
12	+ 7 13.1	+ 7 34.2	+ 7 55.2
18	+ 7 18.4	+ 7 39.5	+ 8 00.4
24	+ 7 23.7	+ 7 44.7	+ 8 05.6

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
22	23 36	9 58	10 25	5 38	13 37
23	24 29	9 58	10 23	5 34	13 34
24	0 29	9 59	10 22	5 31	13 30
25	1 24	10 00	10 20	5 27	13 26

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	22 ′	23 ′	24 ′
0	21.1	21.1	20.9
4	21.1	21.1	20.9
8	21.1	21.1	20.8
12	21.0	21.0	20.8
16	20.9	20.9	20.7
20	20.8	20.8	20.6
24	20.7	20.7	20.5
28	20.6	20.6	20.3
32	20.4	20.4	20.2
36	20.2	20.2	20.0
40	20.0	20.0	19.8
44	19.8	19.8	19.6
48	19.6	19.6	19.4
52	19.3	19.3	19.2
56	19.1	19.1	18.9
60	18.8	18.8	18.7
64	18.5	18.5	18.4
68	18.3	18.3	18.1
72	18.0	18.0	17.9
76	17.7	17.7	17.6
80	17.4	17.4	17.3
84	17.1	17.1	17.0
88	16.8	16.8	16.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	22 ′	23 ′	24 ′
0	12.4	12.4	12.5
4	12.4	12.4	12.5
8	12.4	12.4	12.6
12	12.5	12.5	12.6
16	12.6	12.6	12.7
20	12.7	12.7	12.8
24	12.8	12.8	12.9
28	12.9	12.9	13.1
32	13.2	13.2	13.2
36	13.3	13.3	13.4
40	13.5	13.5	13.6
44	13.7	13.7	13.8
48	13.9	13.9	14.0
52	14.2	14.2	14.2
56	14.4	14.4	14.5
60	14.7	14.7	14.7
64	15.0	15.0	15.0
68	15.2	15.2	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.1	16.1	16.1
84	16.4	16.4	16.4
88	16.7	16.7	16.6
90			

Subtract from table, back cover

Full Moon 23

First Day of Feast of Tabernacles (Succoth) 24

GMT	♈ GHA	VENUS −3.4 GHA	VENUS Dec.	MARS 2.0 GHA	MARS Dec.	JUPITER −2.0 GHA	JUPITER Dec.	SATURN 0.9 GHA	SATURN Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
25 h 0	3 31.0	210 08.0	+11 56.1	204 50.0	+10 16.5	278 03.5	+22 47.6	157 53.9	− 8 11.6	339 43.4	73	+15 21.4	+139
1	18 33.5	225 07.6	55.2	219 51.0	15.9	293 05.8	47.7	172 56.0	11.7	354 09.7	72	15 35.3	+138
2	33 35.9	240 07.1	54.2	234 52.0	15.4	308 08.1	47.7	187 58.2	11.8	8 35.9	72	15 49.1	+136
3	48 38.4	255 06.6	·· 53.2	249 53.0	·· 14.8	323 10.4	·· 47.7	203 00.4	·· 11.9	23 02.1	71	·16 02.7	+135
4	63 40.8	270 06.2	52.2	264 53.9	14.2	338 12.7	47.7	218 02.6	12.0	37 28.2	71	16 16.2	+134
5	78 43.3	285 05.7	51.2	279 54.9	13.6	353 15.0	47.7	233 04.8	12.1	51 54.3	70	16 29.6	+133
6	93 45.8	300 05.2	+11 50.2	294 55.9	+10 13.0	8 17.2	+22 47.7	248 07.0	− 8 12.2	66 20.3	70	+16 42.9	+132
7	108 48.2	315 04.8	49.2	309 56.9	12.5	23 19.5	47.7	263 09.2	12.3	80 46.3	69	16 56.1	+131
8	123 50.7	330 04.3	48.3	324 57.9	11.9	38 21.8	47.7	278 11.4	12.4	95 12.2	69	17 09.2	+129
9	138 53.2	345 03.8	·· 47.3	339 58.8	·· 11.3	53 24.1	·· 47.7	293 13.6	·· 12.5	109 38.1	68	·17 22.1	+128
10	153 55.6	0 03.4	46.3	354 59.8	10.7	68 26.4	47.7	308 15.8	12.6	124 03.9	68	17 34.9	+127
11	168 58.1	15 02.9	45.3	10 00.8	10.1	83 28.7	47.7	323 18.0	12.7	138 29.7	67	17 47.6	+126
12	184 00.6	30 02.4	+11 44.3	25 01.8	+10 09.6	98 31.0	+22 47.7	338 20.2	− 8 12.8	152 55.4	67	+18 00.2	+124
13	199 03.0	45 02.0	43.3	40 02.7	09.0	113 33.3	47.7	353 22.4	12.9	167 21.1	66	18 12.6	+123
14	214 05.5	60 01.5	42.3	55 03.7	08.4	128 35.6	47.7	8 24.6	13.0	181 46.7	66	18 24.9	+121
15	229 08.0	75 01.0	·· 41.3	70 04.7	·· 07.8	143 37.9	·· 47.7	23 26.8	·· 13.2	196 12.3	65	·18 37.0	+121
16	244 10.4	90 00.6	40.3	85 05.7	07.2	158 40.2	47.7	38 29.0	13.3	210 37.8	65	18 49.1	+119
17	259 12.9	105 00.1	39.3	100 06.7	06.7	173 42.5	47.7	53 31.2	13.4	225 03.3	64	19 01.0	+117
18	274 15.3	119 59.6	+11 38.3	115 07.6	+10 06.1	188 44.8	+22 47.7	68 33.4	− 8 13.5	239 28.7	64	+19 12.7	+117
19	289 17.8	134 59.2	37.3	130 08.6	05.5	203 47.1	47.7	83 35.6	13.6	253 54.1	64	19 24.4	+115
20	304 20.3	149 58.7	36.3	145 09.6	04.9	218 49.3	47.7	98 37.8	13.7	268 19.5	63	19 35.9	+113
21	319 22.7	164 58.2	·· 35.3	160 10.6	·· 04.3	233 51.6	·· 47.8	113 40.0	·· 13.8	282 44.8	62	·19 47.2	+112
22	334 25.2	179 57.8	34.3	175 11.5	03.8	248 53.9	47.8	128 42.2	13.9	297 10.0	62	19 58.4	+111
23	349 27.7	194 57.3	33.3	190 12.5	03.2	263 56.2	47.8	143 44.4	14.0	311 35.2	62	20 09.5	+109
26 0	4 30.1	209 56.9	+11 32.3	205 13.5	+10 02.6	278 58.5	+22 47.8	158 46.6	− 8 14.1	326 00.4	61	+20 20.4	+108
1	19 32.6	224 56.4	31.3	220 14.5	02.0	294 00.8	47.8	173 48.8	14.2	340 25.5	61	20 31.2	+106
2	34 35.1	239 55.9	30.3	235 15.5	01.4	309 03.1	47.8	188 51.0	14.3	354 50.6	60	20 41.8	+105
3	49 37.5	254 55.5	·· 29.3	250 16.4	·· 00.8	324 05.4	·· 47.8	203 53.2	·· 14.4	9 15.6	60	·20 52.3	+103
4	64 40.0	269 55.0	28.3	265 17.4	10 00.3	339 07.7	47.8	218 55.4	14.5	23 40.6	59	21 02.6	+102
5	79 42.5	284 54.5	27.3	280 18.4	9 59.7	354 10.0	47.8	233 57.6	14.6	38 05.5	60	21 12.8	+100
6	94 44.9	299 54.1	+11 26.3	295 19.4	+ 9 59.1	9 12.3	+22 47.8	248 59.8	− 8 14.7	52 30.5	58	+21 22.8	+ 99
7	109 47.4	314 53.6	25.3	310 20.4	58.5	24 14.6	47.8	264 02.0	14.8	66 55.3	59	21 32.7	+ 97
8	124 49.8	329 53.2	24.3	325 21.3	57.9	39 16.9	47.8	279 04.2	15.0	81 20.2	58	21 42.4	+ 96
9	139 52.3	344 52.7	·· 23.3	340 22.3	·· 57.3	54 19.2	·· 47.8	294 06.4	·· 15.1	95 45.0	57	·21 52.0	+ 94
10	154 54.8	359 52.2	22.3	355 23.3	56.8	69 21.5	47.8	309 08.6	15.2	110 09.7	57	22 01.4	+ 93
11	169 57.2	14 51.8	21.3	10 24.3	56.2	84 23.8	47.8	324 10.8	15.3	124 34.4	57	22 10.7	+ 91
12	184 59.7	29 51.3	+11 20.3	25 25.3	+ 9 55.6	99 26.1	+22 47.8	339 13.0	− 8 15.4	138 59.1	57	+22 19.8	+ 89
13	200 02.2	44 50.9	19.3	40 26.2	55.0	114 28.4	47.8	354 15.1	15.5	153 23.8	56	22 28.7	+ 88
14	215 04.6	59 50.4	18.3	55 27.2	54.4	129 30.7	47.8	9 17.3	15.6	167 48.4	56	22 37.5	+ 86
15	230 07.1	74 49.9	·· 17.3	70 28.2	·· 53.8	144 33.0	·· 47.8	24 19.5	·· 15.7	182 13.0	56	·22 46.1	+ 85
16	245 09.6	89 49.5	16.3	85 29.2	53.3	159 35.3	47.8	39 21.7	15.8	196 37.6	55	22 54.6	+ 83
17	260 12.0	104 49.0	15.3	100 30.2	52.7	174 37.6	47.8	54 23.9	15.9	211 02.1	55	23 02.9	+ 81
18	275 14.5	119 48.6	+11 14.3	115 31.1	+ 9 52.1	189 39.9	+22 47.9	69 26.1	− 8 16.0	225 26.6	55	+23 11.0	+ 80
19	290 16.9	134 48.1	13.3	130 32.1	51.5	204 42.2	47.9	84 28.3	16.1	239 51.1	55	23 19.0	+ 78
20	305 19.4	149 47.6	12.2	145 33.1	50.9	219 44.5	47.9	99 30.5	16.2	254 15.6	54	23 26.8	+ 77
21	320 21.9	164 47.2	·· 11.2	160 34.1	·· 50.3	234 46.8	·· 47.9	114 32.7	·· 16.3	268 40.0	55	·23 34.5	+ 75
22	335 24.3	179 46.7	10.2	175 35.1	49.8	249 49.1	47.9	129 34.9	16.4	283 04.5	53	23 42.0	+ 73
23	350 26.8	194 46.3	09.2	190 36.0	49.2	264 51.4	47.9	144 37.1	16.5	297 28.8	54	23 49.3	+ 72
27 0	5 29.3	209 45.8	+11 08.2	205 37.0	+ 9 48.6	279 53.7	+22 47.9	159 39.3	− 8 16.6	311 53.2	54	+23 56.5	+ 70
1	20 31.7	224 45.4	07.2	220 38.0	48.0	294 56.0	47.9	174 41.5	16.8	326 17.6	53	24 03.5	+ 68
2	35 34.2	239 44.9	06.2	235 39.0	47.4	309 58.4	47.9	189 43.7	16.9	340 41.9	54	24 10.3	+ 66
3	50 36.7	254 44.4	·· 05.2	250 40.0	·· 46.8	325 00.7	·· 47.9	204 45.9	·· 17.0	355 06.3	53	·24 16.9	+ 65
4	65 39.1	269 44.0	04.1	265 41.0	46.3	340 03.0	47.9	219 48.1	17.1	9 30.6	53	24 23.4	+ 63
5	80 41.6	284 43.5	03.1	280 41.9	45.7	355 05.3	47.9	234 50.3	17.2	23 54.9	53	24 29.7	+ 62
6	95 44.1	299 43.1	+11 02.1	295 42.9	+ 9 45.1	10 07.6	+22 47.9	249 52.5	− 8 17.3	38 19.2	53	+24 35.9	+ 60
7	110 46.5	314 42.6	01.1	310 43.9	44.5	25 09.9	47.9	264 54.7	17.4	52 43.5	52	24 41.9	+ 58
8	125 49.0	329 42.2	11 00.1	325 44.9	43.9	40 12.2	47.9	279 56.9	17.5	67 07.7	53	24 47.7	+ 56
9	140 51.4	344 41.7	·10 59.1	340 45.9	·· 43.3	55 14.5	·· 47.9	294 59.1	·· 17.6	81 32.0	53	·24 53.3	+ 55
10	155 53.9	359 41.3	58.0	355 46.8	42.7	70 16.8	47.9	310 01.3	17.7	95 56.3	53	24 58.8	+ 53
11	170 56.4	14 40.8	57.0	10 47.8	42.2	85 19.1	47.9	325 03.4	17.8	110 20.6	52	25 04.1	+ 51
12	185 58.8	29 40.3	+10 56.0	25 48.8	+ 9 41.6	100 21.4	+22 47.9	340 05.6	− 8 17.9	124 44.8	53	+25 09.2	+ 50
13	201 01.3	44 39.9	55.0	40 49.8	41.0	115 23.7	47.9	355 07.8	18.0	139 09.1	53	25 14.2	+ 48
14	216 03.8	59 39.4	54.0	55 50.8	40.4	130 26.0	47.9	10 10.0	18.1	153 33.4	52	25 19.0	+ 46
15	231 06.2	74 39.0	·· 52.9	70 51.8	·· 39.8	145 28.4	·· 47.9	25 12.2	·· 18.2	167 57.6	53	·25 23.6	+ 45
16	246 08.7	89 38.5	51.9	85 52.7	39.2	160 30.7	47.9	40 14.4	18.3	182 21.9	53	25 28.1	+ 42
17	261 11.2	104 38.1	50.9	100 53.7	38.7	175 33.0	48.0	55 16.6	18.4	196 46.2	53	25 32.3	+ 41
18	276 13.6	119 37.6	+10 49.9	115 54.7	+ 9 38.1	190 35.3	+22 48.0	70 18.8	− 8 18.6	211 10.5	53	+25 36.4	+ 40
19	291 16.1	134 37.2	48.8	130 55.7	37.5	205 37.6	48.0	85 21.0	18.7	225 34.8	53	25 40.4	+ 37
20	306 18.6	149 36.7	47.8	145 56.7	36.9	220 39.9	48.0	100 23.2	18.8	239 59.1	54	25 44.1	+ 36
21	321 21.0	164 36.3	·· 46.8	160 57.7	·· 36.3	235 42.2	·· 48.0	115 25.4	·· 18.9	254 23.5	53	·25 47.7	+ 35
22	336 23.5	179 35.8	45.8	175 58.6	35.7	250 44.5	48.0	130 27.6	19.0	268 47.8	54	25 51.2	+ 32
23	351 25.9	194 35.4	44.7	190 59.6	35.1	265 46.8	48.0	145 29.8	19.1	283 12.2	54	25 54.4	+ 31
24	6 28.4	209 34.9	+10 43.7	206 00.6	+ 9 34.5	280 49.2	+22 48.0	160 32.0	− 8 19.2	297 36.6	54	+25 57.5	+ 29
code	−	− 4	− 10	+ 9	− 6	+ 23	0	+ 21	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
25 0	182 01.5	− 0 38.8
1	197 01.7	39.8
2	212 01.9	40.8
3	227 02.2	41.8
4	242 02.4	42.7
5	257 02.6	43.7
6	272 02.8	− 0 44.7
7	287 03.0	45.7
8	302 03.2	46.6
9	317 03.5	47.6
10	332 03.7	48.6
11	347 03.9	49.6
12	2 04.1	− 0 50.5
13	17 04.3	51.5
14	32 04.5	52.5
15	47 04.8	53.5
16	62 05.0	54.4
17	77 05.2	55.4
18	92 05.4	− 0 56.4
19	107 05.6	57.4
20	122 05.8	58.3
21	137 06.0	− 0 59.3
22	152 06.3	1 00.3
23	167 06.5	01.3
26 0	182 06.7	− 1 02.2
1	197 06.9	03.2
2	212 07.1	04.2
3	227 07.3	05.1
4	242 07.6	06.1
5	257 07.8	07.1
6	272 08.0	− 1 08.1
7	287 08.2	09.0
8	302 08.4	10.0
9	317 08.6	11.0
10	332 08.8	12.0
11	347 09.1	12.9
12	2 09.3	− 1 13.9
13	17 09.5	14.9
14	32 09.7	15.9
15	47 09.9	16.8
16	62 10.1	17.8
17	77 10.3	18.8
18	92 10.5	− 1 19.8
19	107 10.8	20.7
20	122 11.0	21.7
21	137 11.2	22.7
22	152 11.4	23.7
23	167 11.6	24.6
27 0	182 11.8	− 1 25.6
1	197 12.0	26.6
2	212 12.3	27.6
3	227 12.5	28.5
4	242 12.7	29.5
5	257 12.9	30.5
6	272 13.1	− 1 31.5
7	287 13.3	32.4
8	302 13.5	33.4
9	317 13.7	34.4
10	332 14.0	35.4
11	347 14.2	36.3
12	2 14.4	− 1 37.3
13	17 14.6	38.3
14	32 14.8	39.2
15	47 15.0	40.2
16	62 15.2	41.2
17	77 15.4	42.2
18	92 15.6	− 1 43.1
19	107 15.9	44.1
20	122 16.1	45.1
21	137 16.3	46.1
22	152 16.5	47.0
23	167 16.7	48.0
24	182 16.9	− 1 49.0
code	—	− 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.9	−40 29.0
5	Achernar	335 59.3	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.8	−28 54.1
10	Aldebaran	291 40.7	+16 25.2
32	Alioth	167 00.3	+56 12.6
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.4	−47 11.1
15	Alnilam	276 31.8	− 1 13.6
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.3	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.8	−68 57.1
22	Avior	234 36.8	−59 21.3
13	Bellatrix	279 20.0	+ 6 18.8
16	Betelg'se	271 49.8	+ 7 24.2
17	Canopus	264 16.1	−52 39.8
12	Capella	281 40.6	+45 57.2
53	Deneb	50 01.8	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.9	+62 00.0
14	Einath	279 09.2	+28 34.3
47	Eltanin	91 07.0	+51 29.9
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 51.9
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.1	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.4	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.7	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.2	−69 31.3
9	Mirfak	309 44.3	+49 41.9
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.3	−56 53.3
21	Pollux	244 22.5	+28 08.4
20	Procyon	245 46.7	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.0	− 8 14.9
38	Rigil Kent.	140 53.8	−60 39.0
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.3	+56 17.2
45	Shaula	97 22.8	−37 04.5
18	Sirius	259 13.2	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.8	−43 14.4
49	Vega	81 09.3	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 25	26	27
h	m s	m s	m s
0	+ 8 05.6	+ 8 26.3	+ 8 46.9
6	+ 8 10.8	+ 8 31.5	+ 8 52.0
12	+ 8 16.0	+ 8 36.6	+ 8 57.1
18	+ 8 21.2	+ 8 41.8	+ 9 02.1
24	+ 8 26.3	+ 8 46.9	+ 9 07.2

Lat.	Sunrise	Twlt. begins	Moonrise 25	26	27	28
N °	h m	h m	h m	h m	h m	h m
72	5 55	1 07	▭	▭	▭	▭
70	5 55	1 55	15 27	▭	▭	▭
68	5 54	2 25	16 10	▭	▭	▭
66	5 54	2 46	16 40	16 12	▭	▭
64	5 54	3 03	17 02	16 56	16 46	▭
62	5 53	3 16	17 20	17 26	17 41	18 20
60	5 53	3 27	17 35	17 49	18 13	18 59
58	5 53	3 36	17 48	18 07	18 38	19 27
56	5 53	3 44	17 59	18 23	18 58	19 48
54	5 52	3 50	18 09	18 36	19 14	20 06
52	5 52	3 56	18 18	18 48	19 28	20 21
50	5 52	4 01	18 26	18 58	19 40	20 34
45	5 51	4 12	18 43	19 20	20 06	21 01
40	5 51	4 20	18 57	19 38	20 26	21 22
35	5 51	4 26	19 08	19 53	20 44	21 40
30	5 50	4 30	19 19	20 06	20 58	21 55
20	5 50	4 36	19 37	20 28	21 24	22 21
10	5 49	4 39	19 53	20 48	21 45	22 43
0	5 48	4 40	20 08	21 06	22 06	23 04
10	5 47	4 38	20 23	21 25	22 26	23 25
20	5 46	4 34	20 39	21 45	22 48	23 48
30	5 45	4 26	20 58	22 08	23 14	24 14
35	5 44	4 21	21 09	22 21	23 29	24 29
40	5 43	4 14	21 21	22 37	23 46	24 47
45	5 42	4 04	21 36	22 56	24 07	0 07
50	5 41	3 52	21 55	23 19	24 34	0 34
52	5 40	3 46	22 04	23 31	24 47	0 47
54	5 39	3 40	22 14	23 44	25 02	1 02
56	5 39	3 31	22 25	23 59	25 20	1 20
58	5 38	3 23	22 38	24 16	0 16	1 41
60 S	5 37	3 12	22 53	24 38	0 38	2 09

Lat.	Sunset	Twlt. ends	Moonset 25	26	27	28
N °	h m	h m	h m	h m	h m	h m
72	17 45	22 21	▭	▭	▭	▭
70	17 46	21 38	11 56	▭	▭	▭
68	17 47	21 11	11 15	▭	▭	▭
66	17 47	20 50	10 47	13 17	▭	▭
64	17 48	20 35	10 26	12 33	14 48	▭
62	17 48	20 22	10 09	12 04	13 54	15 18
60	17 49	20 12	9 55	11 42	13 21	14 39
58	17 49	20 03	9 43	11 24	12 57	14 11
56	17 49	19 56	9 33	11 10	12 38	13 50
54	17 50	19 50	9 24	10 57	12 22	13 32
52	17 50	19 44	9 16	10 45	12 08	13 17
50	17 50	19 39	9 08	10 35	11 56	13 04
45	17 51	19 29	8 53	10 15	11 31	12 37
40	17 51	19 21	8 40	9 58	11 11	12 16
35	17 52	19 16	8 30	9 44	10 54	11 58
30	17 52	19 12	8 20	9 31	10 40	11 43
20	17 53	19 06	8 04	9 10	10 15	11 17
10	17 54	19 04	7 51	8 52	9 54	10 55
0	17 55	19 04	7 38	8 35	9 35	10 34
10	17 56	19 06	7 25	8 19	9 15	10 13
20	17 57	19 10	7 11	8 01	8 54	9 51
30	17 58	19 18	6 55	7 40	8 30	9 25
35	17 59	19 24	6 46	7 28	8 16	9 09
40	18 00	19 31	6 36	7 14	7 59	8 52
45	18 02	19 42	6 24	6 58	7 40	8 30
50	18 03	19 54	6 10	6 38	7 15	8 03
52	18 04	20 01	6 03	6 29	7 04	7 50
54	18 05	20 08	5 56	6 19	6 50	7 35
56	18 05	20 15	5 47	6 07	6 35	7 17
58	18 06	20 25	5 38	5 53	6 17	6 56
60 S	18 08	20 37	5 27	5 37	5 55	6 28

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
25	1 24	10 00	10 20	5 27	13 26
26	2 22	10 01	10 18	5 23	13 23
27	3 20	10 01	10 17	5 20	13 19
28	4 20	10 02	10 15	5 16	13 16

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	25	26	27
°	′	′	′
0	20.1	19.1	18.0
4	20.1	19.1	18.0
8	20.1	19.1	17.9
12	20.0	19.0	17.9
16	20.0	19.0	17.9
20	19.9	18.9	17.8
24	19.8	18.8	17.8
28	19.7	18.7	17.7
32	19.5	18.6	17.6
36	19.4	18.5	17.6
40	19.2	18.4	17.5
44	19.0	18.3	17.4
48	18.8	18.1	17.3
52	18.6	18.0	17.2
56	18.4	17.8	17.1
60	18.2	17.6	17.0
64	18.0	17.5	16.8
68	17.8	17.3	16.7
72	17.5	17.1	16.6
76	17.3	16.9	16.5
80	17.0	16.7	16.3
84	16.8	16.5	16.2
88	16.6	16.4	16.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	25	26	27
°	′	′	′
0	12.9	13.5	14.2
4	13.0	13.5	14.2
8	13.0	13.6	14.2
12	13.0	13.6	14.2
16	13.1	13.6	14.3
20	13.2	13.7	14.3
24	13.3	13.8	14.4
28	13.4	13.9	14.4
32	13.5	14.0	14.5
36	13.7	14.1	14.6
40	13.9	14.2	14.7
44	14.0	14.4	14.7
48	14.2	14.5	14.8
52	14.4	14.7	15.0
56	14.6	14.8	15.1
60	14.8	15.0	15.2
64	15.1	15.2	15.3
68	15.3	15.4	15.4
72	15.5	15.5	15.5
76	15.8	15.7	15.7
80	16.0	15.9	15.8
84	16.3	16.1	15.9
88	16.5	16.3	16.0
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
28 0	6 28.4	209 34.9	+10 43.7	206 00.6	+ 9 34.5	280 49.2	+22 48.0	160 32.0	− 8 19.2	297 36.6	54	+25 57.5	+ 29
1	21 30.9	224 34.5	42.7	221 01.6	34.0	295 51.5	48.0	175 34.2	19.3	312 01.0	55	26 00.4	+ 28
2	36 33.3	239 34.0	41.7	236 02.6	33.4	310 53.8	48.0	190 36.4	19.4	326 25.5	54	26 03.2	+ 25
3	51 35.8	254 33.6	·· 40.6	251 03.6	·· 32.8	325 56.1	·· 48.0	205 38.6	·· 19.5	340 49.9	55	·26 05.7	+ 24
4	66 38.3	269 33.1	39.6	266 04.5	32.2	340 58.4	48.0	220 40.8	19.6	355 14.4	55	26 08.1	+ 23
5	81 40.7	284 32.7	38.6	281 05.5	31.6	356 00.7	48.0	235 43.0	19.7	9 38.9	56	26 10.4	+ 20
6	96 43.2	299 32.2	+10 37.6	296 06.5	+ 9 31.0	11 03.0	+22 48.0	250 45.1	− 8 19.8	24 03.5	56	+26 12.4	+ 19
7	111 45.7	314 31.8	36.5	311 07.5	30.4	26 05.4	48.0	265 47.3	19.9	38 28.1	56	26 14.3	+ 18
8	126 48.1	329 31.3	35.5	326 08.5	29.9	41 07.7	48.0	280 49.5	20.0	52 52.7	56	26 16.1	+ 15
9	141 50.6	344 30.9	·· 34.5	341 09.5	·· 29.3	56 10.0	·· 48.0	295 51.7	·· 20.1	67 17.3	57	·26 17.6	+ 14
10	156 53.1	359 30.4	33.4	356 10.4	28.7	71 12.3	48.0	310 53.9	20.3	81 42.0	58	26 19.0	+ 12
11	171 55.5	14 30.0	32.4	11 11.4	28.1	86 14.6	48.0	325 56.1	20.4	96 06.8	57	26 20.2	+ 11
12	186 58.0	29 29.5	+10 31.4	26 12.4	+ 9 27.5	101 16.9	+22 48.0	340 58.3	− 8 20.5	110 31.5	59	+26 21.3	+ 9
13	202 00.4	44 29.1	30.3	41 13.4	26.9	116 19.3	48.0	356 00.5	20.6	124 56.4	58	26 22.2	+ 7
14	217 02.9	59 28.6	29.3	56 14.4	26.3	131 21.6	48.0	11 02.7	20.7	139 21.2	59	26 22.9	+ 6
15	232 05.4	74 28.2	·· 28.3	71 15.4	·· 25.7	146 23.9	·· 48.0	26 04.9	·· 20.8	153 46.1	60	·26 23.5	+ 4
16	247 07.8	89 27.7	27.2	86 16.4	25.2	161 26.2	48.0	41 07.1	20.9	168 11.1	60	26 23.9	+ 2
17	262 10.3	104 27.3	26.2	101 17.3	24.6	176 28.5	48.1	56 09.3	21.0	182 36.1	60	26 24.1	+ 1
18	277 12.8	119 26.8	+10 25.2	116 18.3	+ 9 24.0	191 30.8	+22 48.1	71 11.5	− 8 21.1	197 01.1	61	+26 24.2	− 1
19	292 15.2	134 26.4	24.1	131 19.3	23.4	206 33.2	48.1	86 13.7	21.2	211 26.2	62	26 24.1	− 2
20	307 17.7	149 25.9	23.1	146 20.3	22.8	221 35.5	48.1	101 15.9	21.3	225 51.4	62	26 23.9	− 4
21	322 20.2	164 25.5	·· 22.0	161 21.3	·· 22.2	236 37.8	·· 48.1	116 18.1	·· 21.4	240 16.6	62	·26 23.5	− 6
22	337 22.6	179 25.0	21.0	176 22.3	21.6	251 40.1	48.1	131 20.2	21.5	254 41.8	64	26 22.9	− 7
23	352 25.1	194 24.6	20.0	191 23.3	21.0	266 42.4	48.1	146 22.4	21.6	269 07.2	63	26 22.2	− 9
29 0	7 27.6	209 24.1	+10 18.9	206 24.2	+ 9 20.5	281 44.8	+22 48.1	161 24.6	− 8 21.7	283 32.5	65	+26 21.3	− 11
1	22 30.0	224 23.7	17.9	221 25.2	19.9	296 47.1	48.1	176 26.8	21.9	297 58.0	65	26 20.2	− 12
2	37 32.5	239 23.3	16.8	236 26.2	19.3	311 49.4	48.1	191 29.0	22.0	312 23.5	66	26 19.0	− 13
3	52 34.9	254 22.8	·· 15.8	251 27.2	·· 18.7	326 51.7	·· 48.1	206 31.2	·· 22.1	326 49.1	66	·26 17.7	− 15
4	67 37.4	269 22.4	14.8	266 28.2	18.1	341 54.1	48.1	221 33.4	22.2	341 14.7	67	26 16.2	− 17
5	82 39.9	284 21.9	13.7	281 29.2	17.5	356 56.4	48.1	236 35.6	22.3	355 40.4	68	26 14.5	− 18
6	97 42.3	299 21.5	+10 12.7	296 30.2	+ 9 16.9	11 58.7	+22 48.1	251 37.8	− 8 22.4	10 06.2	68	+26 12.7	− 20
7	112 44.8	314 21.0	11.6	311 31.1	16.3	27 01.0	48.1	266 40.0	22.5	24 32.0	69	26 10.7	− 21
8	127 47.3	329 20.6	10.6	326 32.1	15.7	42 03.4	48.1	281 42.2	22.6	38 57.9	70	26 08.6	− 23
9	142 49.7	344 20.1	·· 09.5	341 33.1	·· 15.2	57 05.7	·· 48.1	296 44.4	·· 22.7	53 23.9	70	·26 06.3	− 24
10	157 52.2	359 19.7	08.5	356 34.1	14.6	72 08.0	48.1	311 46.6	22.8	67 49.9	71	26 03.9	− 26
11	172 54.7	14 19.3	07.5	11 35.1	14.0	87 10.3	48.1	326 48.8	22.9	82 16.0	72	26 01.3	− 27
12	187 57.1	29 18.8	+10 06.4	26 36.1	+ 9 13.4	102 12.7	+22 48.1	341 50.9	− 8 23.0	96 42.2	73	+25 58.6	− 29
13	202 59.6	44 18.4	05.4	41 37.1	12.8	117 15.0	48.1	356 53.1	23.1	111 08.5	74	25 55.7	− 30
14	218 02.0	59 17.9	04.3	56 38.1	12.2	132 17.3	48.1	11 55.3	23.2	125 34.9	74	25 52.7	− 32
15	233 04.5	74 17.5	·· 03.3	71 39.0	·· 11.6	147 19.6	·· 48.1	26 57.5	·· 23.3	140 01.3	75	·25 49.5	− 33
16	248 07.0	89 17.0	02.2	86 40.0	11.0	162 22.0	48.1	41 59.7	23.4	154 27.8	76	25 46.2	− 34
17	263 09.4	104 16.6	01.2	101 41.0	10.4	177 24.3	48.1	57 01.9	23.6	168 54.4	77	25 42.8	− 36
18	278 11.9	119 16.2	+10 00.1	116 42.0	+ 9 09.9	192 26.6	+22 48.2	72 04.1	− 8 23.7	183 21.1	77	+25 39.2	− 37
19	293 14.4	134 15.7	9 59.1	131 43.0	09.3	207 28.9	48.2	87 06.3	23.8	197 47.8	78	25 35.5	− 39
20	308 16.8	149 15.3	58.0	146 44.0	08.7	222 31.3	48.2	102 08.5	23.9	212 14.6	79	25 31.6	− 40
21	323 19.3	164 14.8	·· 57.0	161 45.0	·· 08.1	237 33.6	·· 48.2	117 10.7	·· 24.0	226 41.5	80	·25 27.6	− 41
22	338 21.8	179 14.4	55.9	176 46.0	07.5	252 35.9	48.2	132 12.9	24.1	241 08.5	81	25 23.5	− 43
23	353 24.2	194 14.0	54.9	191 47.0	06.9	267 38.3	48.2	147 15.1	24.2	255 35.6	82	25 19.2	− 44
30 0	8 26.7	209 13.5	+ 9 53.8	206 47.9	+ 9 06.3	282 40.6	+22 48.2	162 17.3	− 8 24.3	270 02.8	82	+25 14.8	− 46
1	23 29.2	224 13.1	52.8	221 48.9	05.7	297 42.9	48.2	177 19.4	24.4	284 30.0	84	25 10.2	− 46
2	38 31.6	239 12.6	51.7	236 49.9	05.1	312 45.2	48.2	192 21.6	24.5	298 57.4	84	25 05.6	− 49
3	53 34.1	254 12.2	·· 50.7	251 50.9	·· 04.5	327 47.6	·· 48.2	207 23.8	·· 24.6	313 24.8	85	·25 00.7	− 49
4	68 36.5	269 11.8	49.6	266 51.9	04.0	342 49.9	48.2	222 26.0	24.7	327 52.3	86	24 55.8	− 51
5	83 39.0	284 11.3	48.6	281 52.9	03.4	357 52.2	48.2	237 28.2	24.8	342 19.9	87	24 50.7	− 52
6	98 41.5	299 10.9	+ 9 47.5	296 53.9	+ 9 02.8	12 54.6	+22 48.2	252 30.4	− 8 24.9	356 47.6	88	+24 45.5	− 53
7	113 43.9	314 10.4	46.4	311 54.9	02.2	27 56.9	48.2	267 32.6	25.0	11 15.4	89	24 40.2	− 55
8	128 46.4	329 10.0	45.4	326 55.8	01.6	42 59.2	48.2	282 34.8	25.2	25 43.3	89	24 34.7	− 55
9	143 48.9	344 09.6	·· 44.3	341 56.8	·· 01.0	58 01.6	·· 48.2	297 37.0	·· 25.3	40 11.2	91	·24 29.2	− 57
10	158 51.3	359 09.1	43.3	356 57.8	9 00.4	73 03.9	48.2	312 39.2	25.4	54 39.3	91	24 23.5	− 59
11	173 53.8	14 08.7	42.2	11 58.8	8 59.8	88 06.2	48.2	327 41.4	25.5	69 07.4	93	24 17.6	− 59
12	188 56.3	29 08.3	+ 9 41.2	26 59.8	+ 8 59.2	103 08.6	+22 48.2	342 43.6	− 8 25.6	83 35.7	93	+24 11.7	− 61
13	203 58.7	44 07.8	40.1	42 00.8	58.6	118 10.9	48.2	357 45.7	25.7	98 04.0	94	24 05.6	− 62
14	219 01.2	59 07.4	39.0	57 01.8	58.0	133 13.2	48.2	12 47.9	25.8	112 32.4	95	23 59.4	− 63
15	234 03.7	74 06.9	·· 38.0	72 02.8	·· 57.5	148 15.6	·· 48.2	27 50.1	·· 25.9	127 00.9	96	·23 53.1	− 64
16	249 06.1	89 06.5	36.9	87 03.8	56.9	163 17.9	48.2	42 52.3	26.0	141 29.5	97	23 46.7	− 65
17	264 08.6	104 06.1	35.9	102 04.8	56.3	178 20.2	48.2	57 54.5	26.1	155 58.2	98	23 40.2	− 67
18	279 11.0	119 05.6	+ 9 34.8	117 05.7	+ 8 55.7	193 22.6	+22 48.2	72 56.7	− 8 26.2	170 27.0	99	+23 33.5	− 67
19	294 13.5	134 05.2	33.7	132 06.7	55.1	208 24.9	48.2	87 58.9	26.3	184 55.9	100	23 26.8	− 69
20	309 16.0	149 04.8	32.7	147 07.7	54.5	223 27.3	48.2	103 01.1	26.4	199 24.9	101	23 19.9	− 70
21	324 18.4	164 04.3	·· 31.6	162 08.7	·· 53.9	238 29.6	·· 48.2	118 03.3	·· 26.5	213 54.0	101	·23 12.9	− 71
22	339 20.9	179 03.9	30.6	177 09.7	53.3	253 31.9	48.3	133 05.5	26.6	228 23.1	103	23 05.8	− 72
23	354 23.4	194 03.5	29.5	192 10.7	52.7	268 34.3	48.3	148 07.7	26.8	242 52.4	103	22 58.6	− 73
24	9 25.8	209 03.0	+ 9 28.4	207 11.7	+ 8 52.1	283 36.6	+22 48.3	163 09.8	− 8 26.9	257 21.7	105	+22 51.3	− 74
code	—	− 4	− 10	+ 10	− 6	+ 23	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
28 0	182 16.9	− 1 49.0
1	197 17.1	50.0
2	212 17.3	50.9
3	227 17.5	51.9
4	242 17.8	52.9
5	257 18.0	53.9
6	272 18.2	− 1 54.8
7	287 18.4	55.8
8	302 18.6	56.8
9	317 18.8	57.7
10	332 19.0	58.7
11	347 19.2	1 59.7
12	2 19.4	− 2 00.7
13	17 19.6	01.6
14	32 19.8	02.6
15	47 20.1	03.6
16	62 20.3	04.6
17	77 20.5	05.5
18	92 20.7	− 2 06.5
19	107 20.9	07.5
20	122 21.1	08.5
21	137 21.3	09.4
22	152 21.5	10.4
23	167 21.7	11.4
29 0	182 21.9	− 2 12.3
1	197 22.1	13.3
2	212 22.3	14.3
3	227 22.6	15.3
4	242 22.8	16.2
5	257 23.0	17.2
6	272 23.2	− 2 18.2
7	287 23.4	19.2
8	302 23.6	20.1
9	317 23.8	21.1
10	332 24.0	22.1
11	347 24.2	23.1
12	2 24.4	− 2 24.0
13	17 24.6	25.0
14	32 24.8	26.0
15	47 25.0	26.9
16	62 25.2	27.9
17	77 25.5	28.9
18	92 25.7	− 2 29.9
19	107 25.9	30.8
20	122 26.1	31.8
21	137 26.3	32.8
22	152 26.5	33.8
23	167 26.7	34.7
30 0	182 26.9	− 2 35.7
1	197 27.1	36.7
2	212 27.3	37.6
3	227 27.5	38.6
4	242 27.7	39.6
5	257 27.9	40.6
6	272 28.1	− 2 41.5
7	287 28.3	42.5
8	302 28.5	43.5
9	317 28.7	44.4
10	332 28.9	45.4
11	347 29.1	46.4
12	2 29.3	− 2 47.4
13	17 29.6	48.3
14	32 29.8	49.3
15	47 30.0	50.3
16	62 30.2	51.2
17	77 30.4	52.2
18	92 30.6	− 2 53.2
19	107 30.8	54.2
20	122 31.0	55.1
21	137 31.2	56.1
22	152 31.4	57.1
23	167 31.6	58.0
24	182 31.8	− 2 59.0
code	—	− 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.9	−40 29.0
5	Achernar	335 59.2	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.8	−28 54.1
10	Aldebaran	291 40.7	+16 25.2
32	Alioth	167 00.3	+56 12.6
34	Alkaid	153 34.4	+49 32.7
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.7	− 1 13.6
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.2	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.8	−68 57.1
22	Avior	234 36.8	−59 21.3
13	Bellatrix	279 20.0	+ 6 18.8
16	Betelg'se	271 49.7	+ 7 24.2
17	Canopus	264 16.0	−52 39.8
12	Capella	281 40.5	+45 57.2
53	Deneb	50 01.9	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.9	+62 00.0
14	Elnath	279 09.2	+28 34.3
47	Eltanin	91 07.0	+51 29.9
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.1	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.5	+74 20.8
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.7	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.2	−69 31.3
9	Mirfak	309 44.3	+49 41.9
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.3	−56 53.3
21	Pollux	244 22.5	+28 08.4
20	Procyon	245 46.7	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.0	− 8 14.9
38	Rigil Kent.	140 53.8	−60 39.0
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.3	+56 17.2
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.2	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.8	−43 14.4
49	Vega	81 09.3	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 28	29	30
h	m s	m s	m s
0	+ 9 07.2	+ 9 27.3	+ 9 47.2
6	+ 9 12.3	+ 9 32.3	+ 9 52.1
12	+ 9 17.3	+ 9 37.3	+ 9 57.0
18	+ 9 22.3	+ 9 42.2	+10 01.9
24	+ 9 27.3	+ 9 47.2	+10 06.7

Lat.	Sunrise	Twlt. begins
N °	h m	h m
72	6 08	1 41
70	6 06	2 16
68	6 05	2 41
66	6 03	2 59
64	6 02	3 14
62	6 01	3 25
60	6 00	3 36
58	5 59	3 44
56	5 58	3 50
54	5 58	3 57
52	5 57	4 02
50	5 56	4 07
45	5 55	4 16
40	5 54	4 23
35	5 53	4 28
30	5 52	4 32
20	5 50	4 37
10	5 49	4 39
0	5 47	4 39
10	5 45	4 36
20	5 43	4 30
30	5 41	4 22
35	5 40	4 16
40	5 38	4 08
45	5 36	3 58
50	5 34	3 44
52	5 33	3 38
54	5 32	3 30
56	5 31	3 21
58	5 29	3 11
60	5 28	3 00
S		

Moonrise	28	29	30	1
	h m	h m	h m	h m
72	▭	▭	▭	▭
70	▭	▭	▭	▭
68	▭	▭	▭	21 22
66	▭	▭	19 42	22 01
64	▭	18 37	20 39	22 28
62	18 20	19 37	21 12	22 48
60	18 59	20 10	21 36	23 05
58	19 27	20 35	21 55	23 19
56	19 48	20 55	22 11	23 31
54	20 06	21 11	22 25	23 41
52	20 21	21 25	22 37	23 51
50	20 34	21 38	22 47	23 59
45	21 01	22 03	23 09	24 17
40	21 22	22 23	23 27	24 31
35	21 40	22 40	23 42	24 43
30	21 55	22 55	23 55	24 53
20	22 21	23 19	24 16	0 16
10	22 43	23 41	24 35	0 35
0	23 04	24 00	0 00	0 53
10	23 25	24 20	0 20	1 10
20	23 48	24 41	0 41	1 29
30	24 14	0 14	1 06	1 51
35	24 29	0 29	1 20	2 03
40	24 47	0 47	1 37	2 18
45	0 07	1 08	1 57	2 35
50	0 34	1 35	2 21	2 56
52	0 47	1 49	2 33	3 06
54	1 02	2 04	2 47	3 17
56	1 20	2 21	3 03	3 29
58	1 41	2 43	3 22	3 44
60	2 09	3 11	3 44	4 02

Lat.	Sunset	Twlt. ends
N °	h m	h m
72	17 30	21 48
70	17 32	21 15
68	17 34	20 53
66	17 36	20 36
64	17 37	20 22
62	17 38	20 10
60	17 39	20 01
58	17 40	19 53
56	17 41	19 47
54	17 42	19 41
52	17 43	19 36
50	17 43	19 31
45	17 45	19 23
40	17 46	19 16
35	17 47	19 11
30	17 48	19 07
20	17 50	19 03
10	17 52	19 02
0	17 54	19 03
10	17 56	19 06
20	17 58	19 12
30	18 00	19 20
35	18 02	19 27
40	18 03	19 35
45	18 05	19 45
50	18 08	20 00
52	18 09	20 07
54	18 10	20 14
56	18 11	20 23
58	18 13	20 34
60	18 15	20 47
S		

Moonset	28	29	30	1
	h m	h m	h m	h m
72	▭	▭	▭	▭
70	▭	▭	▭	▭
68	▭	▭	▭	17 51
66	▭	▭	17 46	17 11
64	▭	17 01	16 50	16 43
62	15 18	16 01	16 16	16 22
60	14 39	15 26	15 51	16 05
58	14 11	15 02	15 32	15 50
56	13 50	14 41	15 15	15 37
54	13 32	14 25	15 01	15 26
52	13 17	14 10	14 49	15 16
50	13 04	13 58	14 38	15 08
45	12 37	13 32	14 15	14 49
40	12 16	13 11	13 57	14 34
35	11 58	12 54	13 41	14 21
30	11 43	12 39	13 28	14 09
20	11 17	12 14	13 05	13 50
10	10 55	11 52	12 45	13 33
0	10 34	11 32	12 26	13 17
10	10 13	11 11	12 07	13 01
20	9 51	10 49	11 47	12 43
30	9 25	10 23	11 23	12 23
35	9 09	10 08	11 10	12 11
40	8 52	9 51	10 54	11 58
45	8 30	9 29	10 34	11 41
50	8 03	9 03	10 10	11 21
52	7 50	8 49	9 58	11 12
54	7 35	8 34	9 45	11 01
56	7 17	8 17	9 30	10 49
58	6 56	7 55	9 11	10 35
60	6 28	7 27	8 49	10 18

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
28	4 20	10 02	10 15	5 16	13 16
29	5 18	10 03	10 14	5 12	13 12
30	6 13	10 03	10 12	5 09	13 09
1	7 05	10 04	10 11	5 05	13 05

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	28	29	30
°	′	′	′
0	16.7	15.6	14.5
4	16.7	15.6	14.5
8	16.7	15.6	14.5
12	16.7	15.6	14.6
16	16.7	15.6	14.6
20	16.6	15.6	14.6
24	16.6	15.6	14.6
28	16.6	15.6	14.6
32	16.5	15.6	14.7
36	16.5	15.6	14.7
40	16.5	15.6	14.7
44	16.4	15.6	14.8
48	16.4	15.6	14.8
52	16.3	15.6	14.9
56	16.3	15.6	14.9
60	16.2	15.6	15.0
64	16.2	15.6	15.0
68	16.1	15.6	15.1
72	16.0	15.6	15.1
76	16.0	15.6	15.2
80	15.9	15.6	15.2
84	15.9	15.6	15.3
88	15.8	15.6	15.3
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	28	29	30
°	′	′	′
0	14.9	15.6	16.1
4	14.9	15.6	16.1
8	14.9	15.6	16.1
12	14.9	15.6	16.1
16	14.9	15.6	16.1
20	15.0	15.6	16.1
24	15.0	15.6	16.1
28	15.0	15.6	16.0
32	15.0	15.6	16.0
36	15.1	15.6	16.0
40	15.1	15.6	15.9
44	15.2	15.6	15.9
48	15.2	15.6	15.8
52	15.3	15.6	15.8
56	15.3	15.6	15.8
60	15.4	15.6	15.7
64	15.4	15.6	15.7
68	15.5	15.6	15.6
72	15.5	15.6	15.6
76	15.6	15.6	15.5
80	15.7	15.6	15.4
84	15.7	15.6	15.4
88	15.8	15.6	15.3
90			

Subtract from table, back cover

Last Quarter 29

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
1 h 0	9 25.8	209 03.0	+ 9 28.4	207 11.7	+ 8 52.1	283 36.6	+22 48.3	163 09.8	− 8 26.9	257 21.7	105	+22 51.3	− 74
1	24 28.3	224 02.6	27.4	222 12.7	51.5	298 38.9	48.3	178 12.0	27.0	271 51.2	105	22 43.9	− 76
2	39 30.8	239 02.2	26.3	237 13.7	50.9	313 41.3	48.3	193 14.2	27.1	286 20.7	106	22 36.3	− 76
3	54 33.2	254 01.7	·· 25.2	252 14.7	·· 50.3	328 43.6	·· 48.3	208 16.4	·· 27.2	300 50.3	108	·22 28.7	− 77
4	69 35.7	269 01.3	24.2	267 15.7	49.8	343 46.0	48.3	223 18.6	27.3	315 20.1	108	22 21.0	− 79
5	84 38.2	284 00.9	23.1	282 16.6	49.2	358 48.3	48.3	238 20.8	27.4	329 49.9	109	22 13.1	− 79
6	99 40.6	299 00.4	+ 9 22.0	297 17.6	+ 8 48.6	13 50.6	+22 48.3	253 23.0	− 8 27.5	344 19.8	110	+22 05.2	− 80
7	114 43.1	314 00.0	21.0	312 18.6	48.0	28 53.0	48.3	268 25.2	27.6	358 49.8	111	21 57.2	− 81
8	129 45.5	328 59.6	19.9	327 19.6	47.4	43 55.3	48.3	283 27.4	27.7	13 19.9	112	21 49.1	− 83
9	144 48.0	343 59.1	·· 18.8	342 20.6	·· 46.8	58 57.7	·· 48.3	298 29.6	·· 27.8	27 50.1	112	·21 40.8	− 83
10	159 50.5	358 58.7	17.8	357 21.6	46.2	74 00.0	48.3	313 31.8	27.9	42 20.3	114	21 32.5	− 84
11	174 52.9	13 58.3	16.7	12 22.6	45.6	89 02.3	48.3	328 33.9	28.0	56 50.7	115	21 24.1	− 85
12	189 55.4	28 57.8	+ 9 15.6	27 23.6	+ 8 45.0	104 04.7	+22 48.3	343 36.1	− 8 28.1	71 21.2	115	+21 15.6	− 86
13	204 57.9	43 57.4	14.5	42 24.6	44.4	119 07.0	48.3	358 38.3	28.2	85 51.7	117	21 07.0	− 87
14	220 00.3	58 57.0	13.5	57 25.6	43.8	134 09.4	48.3	13 40.5	28.4	100 22.4	117	20 58.3	− 88
15	235 02.8	73 56.5	·· 12.4	72 26.6	·· 43.2	149 11.7	·· 48.3	28 42.7	·· 28.5	114 53.1	118	·20 49.5	− 89
16	250 05.3	88 56.1	11.3	87 27.5	42.6	164 14.1	48.3	43 44.9	28.6	129 23.9	119	20 40.6	− 90
17	265 07.7	103 55.7	10.3	102 28.5	42.0	179 16.4	48.3	58 47.1	28.7	143 54.8	120	20 31.6	− 90
18	280 10.2	118 55.2	+ 9 09.2	117 29.5	+ 8 41.5	194 18.8	+22 48.3	73 49.3	− 8 28.8	158 25.8	121	+20 22.6	− 91
19	295 12.6	133 54.8	08.1	132 30.5	40.9	209 21.1	48.3	88 51.5	28.9	172 56.9	122	20 13.5	− 93
20	310 15.1	148 54.4	07.0	147 31.5	40.3	224 23.4	48.3	103 53.7	29.0	187 28.1	122	20 04.2	− 93
21	325 17.6	163 53.9	·· 06.0	162 32.5	·· 39.7	239 25.8	·· 48.3	118 55.8	·· 29.1	201 59.3	124	·19 54.9	− 94
22	340 20.0	178 53.5	04.9	177 33.5	39.1	254 28.1	48.3	133 58.0	29.2	216 30.7	124	19 45.5	− 94
23	355 22.5	193 53.1	03.8	192 34.5	38.5	269 30.5	48.3	149 00.2	29.3	231 02.1	125	19 36.1	− 96
2 0	10 25.0	208 52.6	+ 9 02.7	207 35.5	+ 8 37.9	284 32.8	+22 48.3	164 02.4	− 8 29.4	245 33.6	126	+19 26.5	− 96
1	25 27.4	223 52.2	01.7	222 36.5	37.3	299 35.2	48.3	179 04.6	29.5	260 05.2	127	19 16.9	− 97
2	40 29.9	238 51.8	9 00.6	237 37.5	36.7	314 37.5	48.3	194 06.8	29.6	274 36.9	128	19 07.2	− 98
3	55 32.4	253 51.4	· 8 59.5	252 38.5	·· 36.1	329 39.9	·· 48.3	209 09.0	·· 29.7	289 08.7	129	·18 57.4	− 99
4	70 34.8	268 50.9	58.4	267 39.5	35.5	344 42.2	48.4	224 11.2	29.9	303 40.6	129	18 47.5	− 99
5	85 37.3	283 50.5	57.3	282 40.5	34.9	359 44.6	48.4	239 13.4	30.0	318 12.5	130	18 37.6	−100
6	100 39.8	298 50.1	+ 8 56.3	297 41.4	+ 8 34.3	14 46.9	+22 48.4	254 15.5	− 8 30.1	332 44.5	131	+18 27.6	−101
7	115 42.2	313 49.6	55.2	312 42.4	33.7	29 49.3	48.4	269 17.7	30.2	347 16.6	132	18 17.5	−101
8	130 44.7	328 49.2	54.1	327 43.4	33.1	44 51.6	48.4	284 19.9	30.3	1 48.8	133	18 07.4	−103
9	145 47.1	343 48.8	·· 53.0	342 44.4	·· 32.5	59 54.0	·· 48.4	299 22.1	·· 30.4	16 21.1	133	·17 57.1	−103
10	160 49.6	358 48.4	52.0	357 45.4	31.9	74 56.3	48.4	314 24.3	30.5	30 53.4	135	17 46.8	−103
11	175 52.1	13 47.9	50.9	12 46.4	31.3	89 58.7	48.4	329 26.5	30.6	45 25.9	135	17 36.5	−105
12	190 54.5	28 47.5	+ 8 49.8	27 47.4	+ 8 30.8	105 01.0	+22 48.4	344 28.7	− 8 30.7	59 58.4	135	+17 26.0	−105
13	205 57.0	43 47.1	48.7	42 48.4	30.2	120 03.4	48.4	359 30.9	30.8	74 30.9	137	17 15.5	−105
14	220 59.5	58 46.6	47.6	57 49.4	29.6	135 05.7	48.4	14 33.1	30.9	89 03.6	137	17 05.0	−107
15	236 01.9	73 46.2	·· 46.5	72 50.4	·· 29.0	150 08.1	·· 48.4	29 35.3	·· 31.0	103 36.3	138	·16 54.3	−107
16	251 04.4	88 45.8	45.5	87 51.4	28.4	165 10.4	48.4	44 37.4	31.1	118 09.1	139	16 43.6	−107
17	266 06.9	103 45.4	44.4	102 52.4	27.8	180 12.8	48.4	59 39.6	31.2	132 42.0	140	16 32.9	−109
18	281 09.3	118 44.9	+ 8 43.3	117 53.4	+ 8 27.2	195 15.1	+22 48.4	74 41.8	− 8 31.4	147 15.0	140	+16 22.0	−108
19	296 11.8	133 44.5	42.2	132 54.4	26.6	210 17.5	48.4	89 44.0	31.5	161 48.0	141	16 11.2	−110
20	311 14.2	148 44.1	41.1	147 55.4	26.0	225 19.8	48.4	104 46.2	31.6	176 21.1	142	16 00.2	−110
21	326 16.7	163 43.7	·· 40.0	162 56.4	·· 25.4	240 22.2	·· 48.4	119 48.4	·· 31.7	190 54.3	142	·15 49.2	−110
22	341 19.2	178 43.2	38.9	177 57.4	24.8	255 24.6	48.4	134 50.6	31.8	205 27.5	143	15 38.2	−112
23	356 21.6	193 42.8	37.9	192 58.3	24.2	270 26.9	48.4	149 52.8	31.9	220 00.8	144	15 27.0	−111
3 0	11 24.1	208 42.4	+ 8 36.8	207 59.3	+ 8 23.6	285 29.3	+22 48.4	164 54.9	− 8 32.0	234 34.2	145	+15 15.9	−113
1	26 26.6	223 42.0	35.7	223 00.3	23.0	300 31.6	48.4	179 57.1	32.1	249 07.7	145	15 04.6	−113
2	41 29.0	238 41.5	34.6	238 01.3	22.4	315 34.0	48.4	194 59.3	32.2	263 41.2	146	14 53.3	−113
3	56 31.5	253 41.1	·· 33.5	253 02.3	·· 21.8	330 36.3	·· 48.4	210 01.5	·· 32.3	278 14.8	146	·14 42.0	−114
4	71 34.0	268 40.7	32.4	268 03.3	21.2	345 38.7	48.4	225 03.7	32.4	292 48.4	147	14 30.6	−114
5	86 36.4	283 40.3	31.3	283 04.3	20.6	0 41.0	48.4	240 05.9	32.5	307 22.1	148	14 19.2	−115
6	101 38.9	298 39.8	+ 8 30.2	298 05.3	+ 8 20.0	15 43.4	+22 48.4	255 08.1	− 8 32.6	321 55.9	149	+14 07.7	−116
7	116 41.4	313 39.4	29.2	313 06.3	19.4	30 45.8	48.4	270 10.3	32.7	336 29.8	149	13 56.1	−116
8	131 43.8	328 39.0	28.1	328 07.3	18.8	45 48.1	48.4	285 12.5	32.8	351 03.7	149	13 44.5	−116
9	146 46.3	343 38.6	·· 27.0	343 08.3	·· 18.2	60 50.5	·· 48.4	300 14.6	·· 33.0	5 37.6	151	·13 32.9	−117
10	161 48.7	358 38.2	25.9	358 09.3	17.6	75 52.8	48.4	315 16.8	33.1	20 11.7	150	13 21.2	−118
11	176 51.2	13 37.7	24.8	13 10.3	17.1	90 55.2	48.4	330 19.0	33.2	34 45.7	152	13 09.4	−117
12	191 53.7	28 37.3	+ 8 23.7	28 11.3	+ 8 16.5	105 57.6	+22 48.4	345 21.2	− 8 33.3	49 19.9	152	+12 57.7	−119
13	206 56.1	43 36.9	22.6	43 12.3	15.9	120 59.9	48.4	0 23.4	33.4	63 54.1	152	12 45.8	−119
14	221 58.6	58 36.5	21.5	58 13.3	15.3	136 02.3	48.5	15 25.6	33.5	78 28.3	154	12 33.9	−119
15	237 01.1	73 36.0	·· 20.4	73 14.3	·· 14.7	151 04.6	·· 48.5	30 27.8	·· 33.6	93 02.7	153	·12 22.0	−119
16	252 03.5	88 35.6	19.3	88 15.3	14.1	166 07.0	48.5	45 30.0	33.7	107 37.0	154	12 10.1	−120
17	267 06.0	103 35.2	18.2	103 16.3	13.5	181 09.4	48.5	60 32.1	33.8	122 11.4	155	11 58.1	−121
18	282 08.5	118 34.8	+ 8 17.1	118 17.3	+ 8 12.9	196 11.7	+22 48.5	75 34.3	− 8 33.9	136 45.9	156	+11 46.0	−121
19	297 10.9	133 34.4	16.0	133 18.3	12.3	211 14.1	48.5	90 36.5	34.0	151 20.5	155	11 33.9	−121
20	312 13.4	148 33.9	14.9	148 19.3	11.7	226 16.4	48.5	105 38.7	34.1	165 55.0	157	11 21.8	−122
21	327 15.9	163 33.5	·· 13.8	163 20.3	·· 11.1	241 18.8	·· 48.5	120 40.9	·· 34.2	180 29.7	157	·11 09.6	−121
22	342 18.3	178 33.1	12.7	178 21.3	10.5	256 21.2	48.5	135 43.1	34.3	195 04.4	157	10 57.5	−123
23	357 20.8	193 32.7	11.6	193 22.3	09.9	271 23.5	48.5	150 45.3	34.5	209 39.1	158	10 45.2	−123
24	12 23.2	208 32.2	+ 8 10.5	208 23.3	+ 8 09.3	286 25.9	+22 48.5	165 47.5	− 8 34.6	224 13.9	158	+10 32.9	−123
code	−	− 4	− 11	+ 10	− 6	+ 24	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
1 0	182 31.8	− 2 59.0
1	197 32.0	3 00.0
2	212 32.2	01.0
3	227 32.4	01.9
4	242 32.6	02.9
5	257 32.8	03.9
6	272 33.0	− 3 04.8
7	287 33.2	05.8
8	302 33.4	06.8
9	317 33.6	07.8
10	332 33.8	08.7
11	347 34.0	09.7
12	2 34.2	− 3 10.7
13	17 34.4	11.6
14	32 34.6	12.6
15	47 34.8	13.6
16	62 35.0	14.6
17	77 35.2	15.5
18	92 35.4	− 3 16.5
19	107 35.6	17.5
20	122 35.8	18.4
21	137 36.0	19.4
22	152 36.2	20.4
23	167 36.4	21.3
2 0	182 36.6	− 3 22.3
1	197 36.8	23.3
2	212 37.0	24.3
3	227 37.2	25.2
4	242 37.4	26.2
5	257 37.6	27.2
6	272 37.8	− 3 28.1
7	287 38.0	29.1
8	302 38.2	30.1
9	317 38.4	31.0
10	332 38.6	32.0
11	347 38.8	33.0
12	2 39.0	− 3 33.9
13	17 39.2	34.9
14	32 39.4	35.9
15	47 39.6	36.9
16	62 39.8	37.8
17	77 40.0	38.8
18	92 40.2	− 3 39.8
19	107 40.4	40.7
20	122 40.6	41.7
21	137 40.8	42.7
22	152 41.0	43.6
23	167 41.1	44.6
3 0	182 41.3	− 3 45.6
1	197 41.5	46.5
2	212 41.7	47.5
3	227 41.9	48.5
4	242 42.1	49.4
5	257 42.3	50.4
6	272 42.5	− 3 51.4
7	287 42.7	52.4
8	302 42.9	53.3
9	317 43.1	54.3
10	332 43.3	55.3
11	347 43.5	56.2
12	2 43.7	− 3 57.2
13	17 43.9	58.2
14	32 44.1	3 59.1
15	47 44.3	4 00.1
16	62 44.5	01.1
17	77 44.6	02.0
18	92 44.8	− 4 03.0
19	107 45.0	04.0
20	122 45.2	04.9
21	137 45.4	05.9
22	152 45.6	06.9
23	167 45.8	07.8
24	182 46.0	− 4 08.8
code	−	− 10

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.0
5	Achernar	335 59.2	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.8	−28 54.1
10	Aldebaran	291 40.6	+16 25.2
32	Alioth	167 00.3	+56 12.6
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.7	− 1 13.6
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.1	+26 52.3
1	Alpheratz	358 29.6	+28 50.3
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.2	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.8	−68 57.1
22	Avior	234 36.8	−59 21.3
13	Bellatrix	279 19.9	+ 6 18.8
16	Betelg'se	271 49.7	+ 7 24.2
17	Canopus	264 16.0	−52 39.8
12	Capella	281 40.5	+45 57.2
53	Deneb	50 01.9	+45 07.1
28	Denebola	183 19.6	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.8	+61 59.9
14	Elnath	279 09.1	+28 34.3
47	Eltanin	91 07.0	+51 29.9
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.1	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.5	+74 20.7
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.1	−69 31.3
9	Mirfak	309 44.3	+49 42.0
50	Nunki	76 53.7	−26 21.4
52	Peacock	54 29.3	−56 53.3
21	Pollux	244 22.5	+28 08.4
20	Procyon	245 46.6	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.4	+12 11.7
11	Rigel	281 55.0	− 8 14.9
38	Rigil Kent.	140 53.8	−60 39.0
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.3	+56 17.2
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.2	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.8	−43 14.4
49	Vega	81 09.3	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 1	2	3
h	m s	m s	m s
0	+10 06.7	+10 26.0	+10 45.0
6	+10 11.6	+10 30.8	+10 49.7
12	+10 16.4	+10 35.5	+10 54.3
18	+10 21.2	+10 40.3	+10 59.0
24	+10 26.0	+10 45.0	+11 03.6

Lat.	Sunrise	Twlt. begins	Moonrise 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	6 22	2 07	▭	22 25	24 49	0 49
70	6 19	2 36	▭	23 04	25 06	1 06
68	6 16	2 56	21 22	23 31	25 20	1 20
66	6 13	3 12	22 01	23 51	25 31	1 31
64	6 11	3 25	22 28	24 07	0 07	1 40
62	6 09	3 35	22 48	24 20	0 20	1 48
60	6 07	3 44	23 05	24 32	0 32	1 55
58	6 06	3 52	23 19	24 41	0 41	2 01
56	6 04	3 57	23 31	24 50	0 50	2 06
54	6 03	4 02	23 41	24 57	0 57	2 11
52	6 02	4 07	23 51	25 04	1 04	2 15
50	6 01	4 12	23 59	25 10	1 10	2 19
45	5 59	4 20	24 17	0 17	1 23	2 27
40	5 57	4 26	24 31	0 31	1 33	2 34
35	5 55	4 30	24 43	0 43	1 42	2 40
30	5 54	4 34	24 53	0 53	1 50	2 45
20	5 51	4 38	0 16	1 11	2 04	2 54
10	5 49	4 39	0 35	1 27	2 15	3 02
0	5 46	4 38	0 53	1 41	2 26	3 09
10	5 44	4 34	1 10	1 56	2 37	3 16
20	5 41	4 28	1 29	2 11	2 49	3 24
30	5 38	4 18	1 51	2 29	3 02	3 32
35	5 36	4 11	2 03	2 39	3 10	3 37
40	5 33	4 03	2 18	2 51	3 19	3 43
45	5 31	3 52	2 35	3 05	3 29	3 50
50	5 28	3 37	2 56	3 21	3 41	3 58
52	5 26	3 29	3 06	3 29	3 47	4 01
54	5 24	3 21	3 17	3 38	3 53	4 05
56	5 23	3 11	3 29	3 47	4 00	4 09
58	5 21	3 00	3 44	3 58	4 08	4 14
60	5 18	2 46	4 02	4 11	4 16	4 20
S						

Lat.	Sunset	Twlt. ends	Moonset 1	2	3	4
N °	h m	h m	h m	h m	h m	h m
72	17 15	21 22	▭	18 26	17 32	16 59
70	17 18	20 55	▭	17 45	17 12	16 49
68	17 22	20 36	17 51	17 17	16 57	16 41
66	17 24	20 21	17 11	16 55	16 44	16 34
64	17 27	20 09	16 43	16 38	16 33	16 29
62	17 29	20 00	16 22	16 24	16 24	16 24
60	17 30	19 51	16 05	16 12	16 17	16 19
58	17 32	19 44	15 50	16 02	16 10	16 16
56	17 33	19 38	15 37	15 52	16 03	16 12
54	17 35	19 33	15 26	15 44	15 58	16 09
52	17 36	19 29	15 16	15 37	15 53	16 06
50	17 37	19 25	15 08	15 30	15 48	16 04
45	17 39	19 17	14 49	15 16	15 38	15 58
40	17 41	19 11	14 34	15 04	15 30	15 53
35	17 43	19 07	14 21	14 54	15 23	15 49
30	17 45	19 04	14 09	14 45	15 17	15 46
20	17 48	19 01	13 50	14 30	15 06	15 39
10	17 50	19 00	13 33	14 16	14 56	15 34
0	17 53	19 02	13 17	14 04	14 47	15 28
10	17 55	19 05	13 01	13 51	14 38	15 23
20	17 58	19 12	12 43	13 37	14 28	15 17
30	18 02	19 23	12 23	13 21	14 17	15 11
35	18 04	19 30	12 11	13 12	14 10	15 07
40	18 06	19 38	11 58	13 01	14 03	15 02
45	18 09	19 50	11 41	12 48	13 54	14 57
50	18 12	20 05	11 21	12 33	13 43	14 51
52	18 14	20 13	11 12	12 26	13 38	14 48
54	18 16	20 22	11 01	12 18	13 33	14 45
56	18 17	20 31	10 49	12 09	13 27	14 42
58	18 20	20 44	10 35	11 58	13 20	14 38
60	18 22	20 58	10 18	11 47	13 12	14 34
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
1	7 05	10 04	10 11	5 05	13 05
2	7 53	10 05	10 09	5 01	13 02
3	8 37	10 06	10 07	4 57	12 58
4	9 19	10 06	10 06	4 54	12 55

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	1	2	3
°	′	′	′
0	13.6	12.9	12.4
4	13.7	12.9	12.4
8	13.7	12.9	12.4
12	13.7	12.9	12.4
16	13.7	13.0	12.5
20	13.8	13.0	12.6
24	13.8	13.1	12.6
28	13.8	13.2	12.7
32	13.9	13.2	12.8
36	14.0	13.3	12.9
40	14.0	13.4	13.0
44	14.1	13.5	13.1
48	14.2	13.6	13.3
52	14.3	13.7	13.4
56	14.3	13.9	13.5
60	14.4	14.0	13.7
64	14.5	14.1	13.9
68	14.6	14.3	14.0
72	14.7	14.4	14.2
76	14.8	14.5	14.4
80	14.9	14.7	14.5
84	15.0	14.8	14.7
88	15.1	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	1	2	3
°	′	′	′
0	16.6	17.1	17.4
4	16.6	17.1	17.4
8	16.6	17.0	17.3
12	16.6	17.0	17.3
16	16.6	17.0	17.2
20	16.5	16.9	17.2
24	16.5	16.9	17.1
28	16.4	16.8	17.0
32	16.4	16.7	16.9
36	16.3	16.6	16.8
40	16.3	16.5	16.7
44	16.2	16.4	16.6
48	16.1	16.3	16.5
52	16.0	16.2	16.3
56	15.9	16.1	16.2
60	15.8	16.0	16.0
64	15.8	15.8	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.5	15.4	15.4
80	15.4	15.3	15.2
84	15.2	15.1	15.0
88	15.2	15.0	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.0 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
4 0	12 23.2	208 32.2	+ 8 10.5	208 23.3	+ 8 09.3	286 25.9	+22 48.5	165 47.5	− 8 34.6	224 13.9	158	+10 32.9	−123
1	27 25.7	223 31.8	09.4	223 24.2	08.7	301 28.3	48.5	180 49.6	34.7	238 48.7	159	10 20.6	−123
2	42 28.2	238 31.4	08.4	238 25.2	08.1	316 30.6	48.5	195 51.8	34.8	253 23.6	159	10 08.3	−124
3	57 30.6	253 31.0	•• 07.3	253 26.2	•• 07.5	331 33.0	•• 48.5	210 54.0	•• 34.9	267 58.5	159	• 9 55.9	−124
4	72 33.1	268 30.6	06.2	268 27.2	06.9	346 35.4	48.5	225 56.2	35.0	282 33.4	160	9 43.5	−124
5	87 35.6	283 30.1	05.1	283 28.2	06.3	1 37.7	48.5	240 58.4	35.1	297 08.4	161	9 31.1	−125
6	102 38.0	298 29.7	+ 8 04.0	298 29.2	+ 8 05.7	16 40.1	+22 48.5	256 00.6	− 8 35.2	311 43.5	161	+ 9 18.6	−125
7	117 40.5	313 29.3	02.9	313 30.2	05.1	31 42.5	48.5	271 02.8	35.3	326 18.6	161	9 06.1	−125
8	132 43.0	328 28.9	01.8	328 31.2	04.5	46 44.8	48.5	286 05.0	35.4	340 53.7	162	8 53.6	−126
9	147 45.4	343 28.5	• 8 00.6	343 32.2	•• 03.9	61 47.2	•• 48.5	301 07.1	•• 35.5	355 28.9	162	• 8 41.0	−126
10	162 47.9	358 28.1	7 59.5	358 33.2	03.3	76 49.6	48.5	316 09.3	35.6	10 04.1	162	8 28.4	−126
11	177 50.3	13 27.6	58.4	13 34.2	02.7	91 51.9	48.5	331 11.5	35.7	24 39.3	163	8 15.8	−126
12	192 52.8	28 27.2	+ 7 57.3	28 35.2	+ 8 02.1	106 54.3	+22 48.5	346 13.7	− 8 35.8	39 14.6	163	+ 8 03.2	−127
13	207 55.3	43 26.8	56.2	43 36.2	01.5	121 56.7	48.5	1 15.9	36.0	53 49.9	164	7 50.5	−127
14	222 57.7	58 26.4	55.1	58 37.2	00.9	136 59.0	48.5	16 18.1	36.1	68 25.3	163	7 37.8	−127
15	238 00.2	73 26.0	•• 54.0	73 38.2	• 8 00.3	152 01.4	•• 48.5	31 20.3	•• 36.2	83 00.6	165	• 7 25.1	−128
16	253 02.7	88 25.5	52.9	88 39.2	7 59.7	167 03.8	48.5	46 22.5	36.3	97 36.1	164	7 12.3	−127
17	268 05.1	103 25.1	51.8	103 40.2	59.1	182 06.1	48.5	61 24.6	36.4	112 11.5	165	6 59.6	−128
18	283 07.6	118 24.7	+ 7 50.7	118 41.2	+ 7 58.5	197 08.5	+22 48.5	76 26.8	− 8 36.5	126 47.0	165	+ 6 46.8	−128
19	298 10.1	133 24.3	49.6	133 42.2	57.9	212 10.9	48.5	91 29.0	36.6	141 22.5	165	6 34.0	−129
20	313 12.5	148 23.9	48.5	148 43.2	57.3	227 13.3	48.5	106 31.2	36.7	155 58.0	166	6 21.1	−128
21	328 15.0	163 23.5	•• 47.4	163 44.2	•• 56.7	242 15.6	•• 48.5	121 33.4	•• 36.8	170 33.6	166	• 6 08.3	−129
22	343 17.5	178 23.0	46.3	178 45.2	56.1	257 18.0	48.5	136 35.6	36.9	185 09.2	166	5 55.4	−129
23	358 19.9	193 22.6	45.2	193 46.2	55.5	272 20.4	48.5	151 37.8	37.0	199 44.8	167	5 42.5	−129
5 0	13 22.4	208 22.2	+ 7 44.1	208 47.2	+ 7 54.9	287 22.8	+22 48.5	166 40.0	− 8 37.1	214 20.5	166	+ 5 29.6	−129
1	28 24.8	223 21.8	43.0	223 48.2	54.3	302 25.1	48.5	181 42.1	37.2	228 56.1	167	5 16.7	−129
2	43 27.3	238 21.4	41.9	238 49.2	53.7	317 27.5	48.5	196 44.3	37.4	243 31.8	168	5 03.8	−130
3	58 29.8	253 21.0	•• 40.7	253 50.2	•• 53.1	332 29.9	•• 48.5	211 46.5	•• 37.5	258 07.6	167	• 4 50.8	−130
4	73 32.2	268 20.6	39.6	268 51.2	52.5	347 32.2	48.6	226 48.7	37.6	272 43.3	168	4 37.8	−129
5	88 34.7	283 20.1	38.5	283 52.2	51.9	2 34.6	48.6	241 50.9	37.7	287 19.1	167	4 24.9	−130
6	103 37.2	298 19.7	+ 7 37.4	298 53.2	+ 7 51.3	17 37.0	+22 48.6	256 53.1	− 8 37.8	301 54.8	168	+ 4 11.9	−130
7	118 39.6	313 19.3	36.3	313 54.2	50.7	32 39.4	48.6	271 55.3	37.9	316 30.6	169	3 58.9	−131
8	133 42.1	328 18.9	35.2	328 55.2	50.1	47 41.8	48.6	286 57.4	38.0	331 06.5	168	3 45.8	−130
9	148 44.6	343 18.5	•• 34.1	343 56.2	•• 49.5	62 44.1	•• 48.6	301 59.6	•• 38.1	345 42.3	168	• 3 32.8	−130
10	163 47.0	358 18.1	33.0	358 57.2	48.9	77 46.5	48.6	317 01.8	38.2	0 18.1	169	3 19.8	−131
11	178 49.5	13 17.7	31.9	13 58.2	48.3	92 48.9	48.6	332 04.0	38.3	14 54.0	169	3 06.7	−131
12	193 51.9	28 17.2	+ 7 30.7	28 59.2	+ 7 47.7	107 51.3	+22 48.6	347 06.2	− 8 38.4	29 29.9	169	+ 2 53.6	−130
13	208 54.4	43 16.8	29.6	44 00.2	47.1	122 53.6	48.6	2 08.4	38.5	44 05.8	169	2 40.6	−131
14	223 56.9	58 16.4	28.5	59 01.2	46.5	137 56.0	48.6	17 10.6	38.6	58 41.7	169	2 27.5	−131
15	238 59.3	73 16.0	•• 27.4	74 02.2	•• 45.9	152 58.4	•• 48.6	32 12.7	•• 38.7	73 17.6	169	• 2 14.4	−131
16	254 01.8	88 15.6	26.3	89 03.2	45.3	168 00.8	48.6	47 14.9	38.9	87 53.5	170	2 01.3	−131
17	269 04.3	103 15.2	25.2	104 04.2	44.7	183 03.1	48.6	62 17.1	39.0	102 29.5	169	1 48.2	−131
18	284 06.7	118 14.8	+ 7 24.1	119 05.2	+ 7 44.1	198 05.5	+22 48.6	77 19.3	− 8 39.1	117 05.4	170	+ 1 35.1	−131
19	299 09.2	133 14.4	22.9	134 06.2	43.5	213 07.9	48.6	92 21.5	39.2	131 41.4	169	1 22.0	−131
20	314 11.7	148 13.9	21.8	149 07.2	42.9	228 10.3	48.6	107 23.7	39.3	146 17.3	170	1 08.9	−131
21	329 14.1	163 13.5	•• 20.7	164 08.2	•• 42.3	243 12.7	•• 48.6	122 25.9	•• 39.4	160 53.3	169	• 0 55.8	−131
22	344 16.6	178 13.1	19.6	179 09.2	41.7	258 15.1	48.6	137 28.0	39.5	175 29.2	170	0 42.7	−131
23	359 19.1	193 12.7	18.5	194 10.2	41.1	273 17.4	48.6	152 30.2	39.6	190 05.2	170	0 29.6	−132
6 0	14 21.5	208 12.3	+ 7 17.4	209 11.2	+ 7 40.5	288 19.8	+22 48.6	167 32.4	− 8 39.7	204 41.2	170	+ 0 16.4	−131
1	29 24.0	223 11.9	16.2	224 12.2	39.9	303 22.2	48.6	182 34.6	39.8	219 17.2	170	+ 0 03.3	−131
2	44 26.4	238 11.5	15.1	239 13.2	39.3	318 24.6	48.6	197 36.8	39.9	233 53.2	169	− 0 09.8	−131
3	59 28.9	253 11.1	•• 14.0	254 14.2	•• 38.7	333 27.0	•• 48.6	212 39.0	•• 40.0	248 29.1	170	• 0 22.9	−131
4	74 31.4	268 10.6	12.9	269 15.2	38.1	348 29.3	48.6	227 41.2	40.1	263 05.1	170	0 36.0	−131
5	89 33.8	283 10.2	11.8	284 16.2	37.5	3 31.7	48.6	242 43.3	40.2	277 41.1	170	0 49.1	−131
6	104 36.3	298 09.8	+ 7 10.6	299 17.2	+ 7 36.9	18 34.1	+22 48.6	257 45.5	− 8 40.4	292 17.1	169	− 1 02.2	−131
7	119 38.8	313 09.4	09.5	314 18.2	36.3	33 36.5	48.6	272 47.7	40.5	306 53.0	170	1 15.3	−131
8	134 41.2	328 09.0	08.4	329 19.2	35.7	48 38.9	48.6	287 49.9	40.6	321 29.0	170	1 28.4	−131
9	149 43.7	343 08.6	•• 07.3	344 20.2	•• 35.1	63 41.3	•• 48.6	302 52.1	•• 40.7	336 05.0	169	• 1 41.5	−131
10	164 46.2	358 08.2	06.2	359 21.2	34.5	78 43.7	48.6	317 54.3	40.8	350 40.9	170	1 54.6	−131
11	179 48.6	13 07.8	05.0	14 22.2	33.9	93 46.0	48.6	332 56.5	40.9	5 16.9	169	2 07.7	−131
12	194 51.1	28 07.4	+ 7 03.9	29 23.2	+ 7 33.3	108 48.4	+22 48.6	347 58.6	− 8 41.0	19 52.8	169	− 2 20.8	−130
13	209 53.5	43 07.0	02.8	44 24.2	32.7	123 50.8	48.6	3 00.8	41.1	34 28.7	170	2 33.8	−131
14	224 56.0	58 06.5	01.7	59 25.2	32.1	138 53.2	48.6	18 03.0	41.2	49 04.7	169	2 46.9	−130
15	239 58.5	73 06.1	• 7 00.5	74 26.2	•• 31.5	153 55.6	•• 48.6	33 05.2	•• 41.3	63 40.6	169	• 2 59.9	−130
16	255 00.9	88 05.7	6 59.4	89 27.3	30.9	168 58.0	48.6	48 07.4	41.4	78 16.5	169	3 12.9	−131
17	270 03.4	103 05.3	58.3	104 28.3	30.3	184 00.4	48.6	63 09.6	41.5	92 52.4	169	3 26.0	−130
18	285 05.9	118 04.9	+ 6 57.2	119 29.3	+ 7 29.7	199 02.7	+22 48.6	78 11.8	− 8 41.6	107 28.3	168	− 3 39.0	−130
19	300 08.3	133 04.5	56.0	134 30.3	29.1	214 05.1	48.6	93 13.9	41.8	122 04.1	169	3 52.0	−129
20	315 10.8	148 04.1	54.9	149 31.3	28.5	229 07.5	48.6	108 16.1	41.9	136 40.0	168	4 04.9	−130
21	330 13.3	163 03.7	•• 53.8	164 32.3	•• 27.9	244 09.9	•• 48.6	123 18.3	•• 42.0	151 15.8	168	• 4 17.9	−130
22	345 15.7	178 03.3	52.7	179 33.3	27.3	259 12.3	48.6	138 20.5	42.1	165 51.6	168	4 30.9	−129
23	0 18.2	193 02.9	51.5	194 34.3	26.7	274 14.7	48.7	153 22.7	42.2	180 27.4	168	4 43.8	−129
24	15 20.7	208 02.5	+ 6 50.4	209 35.3	+ 7 26.1	289 17.1	+22 48.7	168 24.9	− 8 42.3	195 03.2	167	− 4 56.7	−129
code	−	− 4	− 11	+ 10	− 6	+ 23	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
4 0	182 46.0	− 4 08.8
1	197 46.2	09.8
2	212 46.4	10.7
3	227 46.6	11.7
4	242 46.8	12.7
5	257 47.0	13.6
6	272 47.1	− 4 14.6
7	287 47.3	15.6
8	302 47.5	16.5
9	317 47.7	17.5
10	332 47.9	18.5
11	347 48.1	19.4
12	2 48.3	− 4 20.4
13	17 48.5	21.3
14	32 48.7	22.3
15	47 48.9	23.3
16	62 49.1	24.2
17	77 49.2	25.2
18	92 49.4	− 4 26.2
19	107 49.6	27.1
20	122 49.8	28.1
21	137 50.0	29.1
22	152 50.2	30.0
23	167 50.4	31.0
5 0	182 50.6	− 4 32.0
1	197 50.8	32.9
2	212 50.9	33.9
3	227 51.1	34.9
4	242 51.3	35.8
5	257 51.5	36.8
6	272 51.7	− 4 37.7
7	287 51.9	38.7
8	302 52.1	39.7
9	317 52.3	40.6
10	332 52.4	41.6
11	347 52.6	42.6
12	2 52.8	− 4 43.5
13	17 53.0	44.5
14	32 53.2	45.5
15	47 53.4	46.4
16	62 53.6	47.4
17	77 53.7	48.3
18	92 53.9	− 4 49.3
19	107 54.1	50.3
20	122 54.3	51.2
21	137 54.5	52.2
22	152 54.7	53.2
23	167 54.9	54.1
6 0	182 55.0	− 4 55.1
1	197 55.2	56.0
2	212 55.4	57.0
3	227 55.6	58.0
4	242 55.8	58.9
5	257 56.0	4 59.9
6	272 56.1	− 5 00.8
7	287 56.3	01.8
8	302 56.5	02.8
9	317 56.7	03.7
10	332 56.9	04.7
11	347 57.1	05.7
12	2 57.2	− 5 06.6
13	17 57.4	07.6
14	32 57.6	08.5
15	47 57.8	09.5
16	62 58.0	10.5
17	77 58.2	11.4
18	92 58.3	− 5 12.4
19	107 58.5	13.3
20	122 58.7	14.3
21	137 58.9	15.3
22	152 59.1	16.2
23	167 59.2	17.2
24	182 59.4	− 5 18.1
code	—	− 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.0
5	Achernar	335 59.2	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.7	−28 54.1
10	Aldebaran	291 40.6	+16 25.2
32	Alioth	167 00.3	+56 12.6
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.7	− 1 13.6
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.1	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.2	−42 33.2
42	Antares	113 21.4	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.8	−68 57.1
22	Avior	234 36.7	−59 21.3
13	Bellatrix	279 19.9	+ 6 18.8
16	Betelg'se	271 49.7	+ 7 24.2
17	Canopus	264 16.0	−52 39.8
12	Capella	281 40.5	+45 57.2
53	Deneb	50 01.9	+45 07.2
28	Denebola	183 19.5	+14 49.9
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.8	+61 59.9
14	Elnath	279 09.1	+28 34.3
47	Eltanin	91 07.1	+51 29.9
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.1	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.6	+74 20.7
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.1	−69 31.3
9	Mirfak	309 44.2	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.3	−56 53.3
21	Pollux	244 22.5	+28 08.4
20	Procyon	245 46.6	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 54.9	− 8 14.9
38	Rigil Kent.	140 53.8	−60 39.0
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.2
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.2	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.8	−43 14.4
49	Vega	81 09.3	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 4 h m	5 h m	6 h m	7 h m
72	6 36	2 29	0 49	2 47	4 39	6 31
70	6 31	2 52	1 06	2 54	4 38	6 22
68	6 26	3 11	1 20	3 00	4 37	6 14
66	6 22	3 24	1 31	3 05	4 36	6 08
64	6 19	3 35	1 40	3 09	4 35	6 02
62	6 17	3 44	1 48	3 12	4 35	5 57
60	6 14	3 52	1 55	3 15	4 34	5 53
58	6 12	3 58	2 01	3 18	4 34	5 50
56	6 10	4 04	2 06	3 20	4 34	5 47
54	6 09	4 09	2 11	3 22	4 33	5 44
52	6 07	4 12	2 15	3 24	4 33	5 41
50	6 06	4 16	2 19	3 26	4 33	5 39
45	6 03	4 23	2 27	3 30	4 32	5 34
40	6 00	4 29	2 34	3 33	4 31	5 30
35	5 58	4 33	2 40	3 36	4 31	5 26
30	5 55	4 36	2 45	3 38	4 31	5 23
20	5 52	4 39	2 54	3 42	4 30	5 18
10	5 48	4 38	3 02	3 46	4 29	5 13
0	5 45	4 37	3 09	3 49	4 29	5 08
10	5 42	4 32	3 16	3 53	4 28	5 04
20	5 38	4 25	3 24	3 56	4 28	5 00
30	5 34	4 14	3 32	4 00	4 27	4 54
35	5 31	4 07	3 37	4 03	4 27	4 51
40	5 28	3 57	3 43	4 05	4 26	4 48
45	5 25	3 45	3 50	4 08	4 26	4 44
50	5 21	3 29	3 58	4 12	4 26	4 39
52	5 19	3 21	4 01	4 14	4 25	4 37
54	5 17	3 12	4 05	4 15	4 25	4 35
56	5 15	3 01	4 09	4 17	4 25	4 32
58	5 12	2 49	4 14	4 20	4 25	4 30
60	5 09	2 33	4 20	4 22	4 24	4 26
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 4 h m	5 h m	6 h m	7 h m
72	16 59	20 59	16 59	16 32	16 06	15 38
70	17 05	20 38	16 49	16 29	16 10	15 50
68	17 09	20 20	16 41	16 27	16 14	16 00
66	17 13	20 08	16 34	16 26	16 17	16 08
64	17 16	19 57	16 29	16 24	16 20	16 15
62	17 19	19 49	16 24	16 23	16 22	16 21
60	17 21	19 41	16 19	16 22	16 24	16 26
58	17 24	19 35	16 16	16 21	16 26	16 31
56	17 26	19 30	16 12	16 20	16 27	16 35
54	17 27	19 25	16 09	16 19	16 29	16 39
52	17 29	19 21	16 06	16 18	16 30	16 42
50	17 30	19 18	16 04	16 18	16 31	16 46
45	17 34	19 12	15 58	16 16	16 34	16 52
40	17 36	19 06	15 53	16 15	16 36	16 58
35	17 39	19 03	15 49	16 14	16 38	17 03
30	17 41	19 00	15 46	16 13	16 40	17 07
20	17 45	18 58	15 39	16 11	16 43	17 15
10	17 48	18 58	15 34	16 10	16 45	17 22
0	17 52	19 01	15 28	16 08	16 48	17 28
10	17 55	19 05	15 23	16 07	16 50	17 34
20	17 59	19 13	15 17	16 05	16 53	17 41
30	18 04	19 25	15 11	16 04	16 56	17 49
35	18 06	19 32	15 07	16 02	16 58	17 53
40	18 09	19 42	15 02	16 01	17 00	17 58
45	18 13	19 55	14 57	16 00	17 02	18 04
50	18 17	20 12	14 51	15 58	17 05	18 11
52	18 19	20 20	14 48	15 57	17 06	18 15
54	18 21	20 29	14 45	15 57	17 07	18 18
56	18 24	20 41	14 42	15 56	17 09	18 22
58	18 26	20 53	14 38	15 54	17 10	18 27
60	18 29	21 09	14 34	15 53	17 12	18 32
S						

GMT h	Equation of Time (App.− Mean) 4 m s	5 m s	6 m s
0	+11 03.6	+11 21.9	+11 39.8
6	+11 08.2	+11 26.4	+11 44.2
12	+11 12.8	+11 30.9	+11 48.6
18	+11 17.4	+11 35.4	+11 53.0
24	+11 21.9	+11 39.8	+11 57.3

GMT of Transit Meridian of Greenwich DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
4	9 19	10 06	10 06	4 54	12 55
5	9 59	10 07	10 04	4 50	12 52
6	10 38	10 08	10 03	4 46	12 48
7	11 18	10 08	10 01	4 42	12 45

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	4 ′	5 ′	6 ′
0	12.0	11.7	11.6
4	12.0	11.7	11.6
8	12.0	11.8	11.7
12	12.1	11.8	11.7
16	12.1	11.9	11.8
20	12.2	12.0	11.8
24	12.3	12.0	11.9
28	12.4	12.1	12.0
32	12.5	12.2	12.1
36	12.6	12.4	12.3
40	12.7	12.5	12.4
44	12.8	12.6	12.6
48	13.0	12.8	12.7
52	13.1	13.0	12.9
56	13.3	13.1	13.1
60	13.5	13.3	13.3
64	13.6	13.5	13.4
68	13.8	13.7	13.6
72	14.0	13.9	13.9
76	14.2	14.1	14.1
80	14.4	14.3	14.3
84	14.6	14.5	14.5
88	14.7	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	4 ′	5 ′	6 ′
0	17.6	17.7	17.8
4	17.6	17.7	17.8
8	17.5	17.7	17.8
12	17.5	17.6	17.7
16	17.5	17.6	17.7
20	17.4	17.5	17.6
24	17.3	17.4	17.5
28	17.2	17.3	17.4
32	17.1	17.2	17.3
36	17.0	17.1	17.2
40	16.9	17.0	17.0
44	16.7	16.8	16.9
48	16.6	16.7	16.7
52	16.4	16.5	16.5
56	16.3	16.3	16.4
60	16.1	16.1	16.2
64	15.9	16.0	16.0
68	15.7	15.8	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.1
84	15.0	14.9	14.9
88	14.8	14.8	14.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
7 0	15 20.7	208 02.5	+ 6 50.4	209 35.3	+ 7 26.1	289 17.1	+22 48.7	168 24.9	− 8 42.3	195 03.2	167	− 4 56.7	−129
1	30 23.1	223 02.1	49.3	224 36.3	25.5	304 19.5	48.7	183 27.0	42.4	209 38.9	168	5 09.6	−129
2	45 25.6	238 01.7	48.2	239 37.3	24.9	319 21.9	48.7	198 29.2	42.5	224 14.7	167	5 22.5	−129
3	60 28.0	253 01.2	·· 47.0	254 38.3	·· 24.3	334 24.3	·· 48.7	213 31.4	·· 42.6	238 50.4	167	· 5 35.4	−128
4	75 30.5	268 00.8	45.9	269 39.3	23.7	349 26.7	48.7	228 33.6	42.7	253 26.1	167	5 48.2	−128
5	90 33.0	283 00.4	44.8	284 40.3	23.1	4 29.0	48.7	243 35.8	42.8	268 01.8	166	6 01.0	−128
6	105 35.4	298 00.0	+ 6 43.6	299 41.3	+ 7 22.5	19 31.4	+22 48.7	258 38.0	− 8 42.9	282 37.4	166	− 6 13.8	−128
7	120 37.9	312 59.6	42.5	314 42.3	21.9	34 33.8	48.7	273 40.2	43.0	297 13.0	166	6 26.6	−128
8	135 40.4	327 59.2	41.4	329 43.3	21.3	49 36.2	48.7	288 42.3	43.1	311 48.6	166	6 39.4	−127
9	150 42.8	342 58.8	·· 40.2	344 44.3	·· 20.7	64 38.6	·· 48.7	303 44.5	·· 43.3	326 24.2	166	· 6 52.1	−127
10	165 45.3	357 58.4	39.1	359 45.3	20.1	79 41.0	48.7	318 46.7	43.4	340 59.8	165	7 04.8	−127
11	180 47.8	12 58.0	38.0	14 46.3	19.5	94 43.4	48.7	333 48.9	43.5	355 35.3	165	7 17.5	−127
12	195 50.2	27 57.6	+ 6 36.9	29 47.3	+ 7 18.9	109 45.8	+22 48.7	348 51.1	− 8 43.6	10 10.8	164	− 7 30.2	−126
13	210 52.7	42 57.2	35.7	44 48.3	18.3	124 48.2	48.7	3 53.3	43.7	24 46.2	165	7 42.8	−126
14	225 55.2	57 56.8	34.6	59 49.3	17.7	139 50.6	48.7	18 55.4	43.8	39 21.7	164	7 55.4	−126
15	240 57.6	72 56.4	·· 33.5	74 50.3	·· 17.1	154 53.0	·· 48.7	33 57.6	·· 43.9	53 57.1	163	· 8 08.0	−125
16	256 00.1	87 56.0	32.3	89 51.3	16.5	169 55.4	48.7	48 59.8	44.0	68 32.4	164	8 20.5	−126
17	271 02.5	102 55.6	31.2	104 52.4	15.9	184 57.8	48.7	64 02.0	44.1	83 07.8	163	8 33.1	−124
18	286 05.0	117 55.2	+ 6 30.1	119 53.4	+ 7 15.3	200 00.2	+22 48.7	79 04.2	− 8 44.2	97 43.1	162	− 8 45.5	−125
19	301 07.5	132 54.7	28.9	134 54.4	14.6	215 02.6	48.7	94 06.4	44.3	112 18.3	163	8 58.0	−124
20	316 09.9	147 54.3	27.8	149 55.4	14.0	230 05.0	48.7	109 08.6	44.4	126 53.6	162	9 10.4	−124
21	331 12.4	162 53.9	·· 26.7	164 56.4	·· 13.4	245 07.4	·· 48.7	124 10.7	·· 44.5	141 28.8	161	· 9 22.8	−124
22	346 14.9	177 53.5	25.5	179 57.4	12.8	260 09.8	48.7	139 12.9	44.7	156 03.9	161	9 35.2	−123
23	1 17.3	192 53.1	24.4	194 58.4	12.2	275 12.2	48.7	154 15.1	44.8	170 39.0	161	9 47.5	−123
8 0	16 19.8	207 52.7	+ 6 23.2	209 59.4	+ 7 11.6	290 14.6	+22 48.7	169 17.3	− 8 44.9	185 14.1	161	− 9 59.8	−123
1	31 22.3	222 52.3	22.1	225 00.4	11.0	305 17.0	48.7	184 19.5	45.0	199 49.2	160	10 12.1	−122
2	46 24.7	237 51.9	21.0	240 01.4	10.4	320 19.4	48.7	199 21.7	45.1	214 24.2	159	10 24.3	−122
3	61 27.2	252 51.5	·· 19.8	255 02.4	·· 09.8	335 21.8	·· 48.7	214 23.8	·· 45.2	228 59.1	159	· 10 36.5	−121
4	76 29.6	267 51.1	18.7	270 03.4	09.2	350 24.2	48.7	229 26.0	45.3	243 34.0	159	10 48.6	−121
5	91 32.1	282 50.7	17.6	285 04.4	08.6	5 26.6	48.7	244 28.2	45.4	258 08.9	158	11 00.7	−121
6	106 34.6	297 50.3	+ 6 16.4	300 05.4	+ 7 08.0	20 29.0	+22 48.7	259 30.4	− 8 45.5	272 43.7	158	−11 12.8	−120
7	121 37.0	312 49.9	15.3	315 06.4	07.4	35 31.4	48.7	274 32.6	45.6	287 18.5	158	11 24.8	−120
8	136 39.5	327 49.5	14.1	330 07.4	06.8	50 33.8	48.7	289 34.8	45.7	301 53.3	157	11 36.8	−120
9	151 42.0	342 49.1	·· 13.0	345 08.4	·· 06.2	65 36.2	·· 48.7	304 36.9	·· 45.8	316 28.0	156	· 11 48.8	−119
10	166 44.4	357 48.7	11.9	0 09.4	05.6	80 38.6	48.7	319 39.1	45.9	331 02.6	156	12 00.7	−118
11	181 46.9	12 48.3	10.7	15 10.5	05.0	95 41.0	48.7	334 41.3	46.0	345 37.2	156	12 12.5	−118
12	196 49.4	27 47.9	+ 6 09.6	30 11.5	+ 7 04.4	110 43.4	+22 48.7	349 43.5	− 8 46.2	0 11.8	155	−12 24.3	−118
13	211 51.8	42 47.5	08.4	45 12.5	03.8	125 45.8	48.7	4 45.7	46.3	14 46.3	155	12 36.1	−117
14	226 54.3	57 47.1	07.3	60 13.5	03.2	140 48.2	48.7	19 47.9	46.4	29 20.8	154	12 47.8	−117
15	241 56.8	72 46.7	·· 06.2	75 14.5	·· 02.6	155 50.6	·· 48.7	34 50.0	·· 46.5	43 55.2	153	· 12 59.5	−116
16	256 59.2	87 46.3	05.0	90 15.5	02.0	170 53.0	48.7	49 52.2	46.6	58 29.5	153	13 11.1	−116
17	272 01.7	102 45.9	03.9	105 16.5	01.4	185 55.4	48.7	64 54.4	46.7	73 03.8	153	13 22.7	−115
18	287 04.1	117 45.5	+ 6 02.7	120 17.5	+ 7 00.8	200 57.8	+22 48.7	79 56.6	− 8 46.8	87 38.1	152	−13 34.2	−115
19	302 06.6	132 45.1	01.6	135 18.5	7 00.2	216 00.2	48.7	94 58.8	46.9	102 12.3	152	13 45.7	−114
20	317 09.1	147 44.7	6 00.5	150 19.5	6 59.6	231 02.6	48.7	110 01.0	47.0	116 46.5	151	13 57.1	−114
21	332 11.5	162 44.3	· 5 59.3	165 20.5	·· 58.9	246 05.1	·· 48.7	125 03.1	·· 47.1	131 20.6	150	· 14 08.5	−113
22	347 14.0	177 43.9	58.2	180 21.5	58.3	261 07.5	48.7	140 05.3	47.2	145 54.6	150	14 19.8	−113
23	2 16.5	192 43.5	57.0	195 22.5	57.7	276 09.9	48.7	155 07.5	47.3	160 28.6	149	14 31.1	−112
9 0	17 18.9	207 43.1	+ 5 55.9	210 23.5	+ 6 57.1	291 12.3	+22 48.7	170 09.7	− 8 47.4	175 02.5	149	−14 42.3	−112
1	32 21.4	222 42.7	54.7	225 24.6	56.5	306 14.7	48.7	185 11.9	47.6	189 36.4	148	14 53.5	−110
2	47 23.9	237 42.3	53.6	240 25.6	55.9	321 17.1	48.7	200 14.1	47.7	204 10.2	148	15 04.5	−111
3	62 26.3	252 41.9	·· 52.4	255 26.6	·· 55.3	336 19.5	·· 48.7	215 16.2	·· 47.8	218 44.0	147	· 15 15.6	−110
4	77 28.8	267 41.5	51.3	270 27.6	54.7	351 21.9	48.7	230 18.4	47.9	233 17.7	146	15 26.6	−109
5	92 31.3	282 41.1	50.1	285 28.6	54.1	6 24.3	48.7	245 20.6	48.0	247 51.3	146	15 37.5	−109
6	107 33.7	297 40.7	+ 5 49.0	300 29.6	+ 6 53.5	21 26.7	+22 48.8	260 22.8	− 8 48.1	262 24.9	145	−15 48.4	−108
7	122 36.2	312 40.3	47.9	315 30.6	52.9	36 29.1	48.8	275 25.0	48.2	276 58.4	145	15 59.2	−107
8	137 38.6	327 39.9	46.7	330 31.6	52.3	51 31.6	48.8	290 27.2	48.3	291 31.9	144	16 09.9	−107
9	152 41.1	342 39.5	·· 45.6	345 32.6	·· 51.7	66 34.0	·· 48.8	305 29.3	·· 48.4	306 05.3	143	· 16 20.6	−106
10	167 43.6	357 39.1	44.4	0 33.6	51.1	81 36.4	48.8	320 31.5	48.5	320 38.6	143	16 31.2	−105
11	182 46.0	12 38.7	43.3	15 34.6	50.5	96 38.8	48.8	335 33.7	48.6	335 11.9	142	16 41.7	−105
12	197 48.5	27 38.3	+ 5 42.1	30 35.6	+ 6 49.9	111 41.2	+22 48.8	350 35.9	− 8 48.7	349 45.1	142	−16 52.2	−105
13	212 51.0	42 37.9	41.0	45 36.6	49.3	126 43.6	48.8	5 38.1	48.8	4 18.3	141	17 02.7	−103
14	227 53.4	57 37.5	39.8	60 37.7	48.7	141 46.0	48.8	20 40.3	49.0	18 51.4	140	17 13.0	−103
15	242 55.9	72 37.1	·· 38.7	75 38.7	·· 48.1	156 48.5	·· 48.8	35 42.4	·· 49.1	33 24.4	139	· 17 23.3	−102
16	257 58.4	87 36.7	37.5	90 39.7	47.4	171 50.9	48.8	50 44.6	49.2	47 57.3	139	17 33.5	−101
17	273 00.8	102 36.3	36.4	105 40.7	46.8	186 53.3	48.8	65 46.8	49.3	62 30.2	139	17 43.6	−101
18	288 03.3	117 35.9	+ 5 35.2	120 41.7	+ 6 46.2	201 55.7	+22 48.8	80 49.0	− 8 49.4	77 03.1	137	−17 53.7	−100
19	303 05.7	132 35.5	34.1	135 42.7	45.6	216 58.1	48.8	95 51.2	49.5	91 35.8	137	18 03.7	− 99
20	318 08.2	147 35.1	32.9	150 43.7	45.0	232 00.5	48.8	110 53.3	49.6	106 08.5	137	18 13.6	− 99
21	333 10.7	162 34.7	·· 31.8	165 44.7	·· 44.4	247 02.9	·· 48.8	125 55.5	·· 49.7	120 41.2	135	· 18 23.5	− 98
22	348 13.1	177 34.3	30.6	180 45.7	43.8	262 05.4	48.8	140 57.7	49.8	135 13.7	135	18 33.3	− 97
23	3 15.6	192 33.9	29.5	195 46.7	43.2	277 07.8	48.8	155 59.9	49.9	149 46.2	134	18 43.0	− 96
24	18 18.1	207 33.5	+ 5 28.3	210 47.7	+ 6 42.6	292 10.2	+22 48.8	171 02.1	− 8 50.0	164 18.6	134	−18 52.6	− 96
code	–	− 4	− 12	+ 10	− 6	+ 24	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
7 0	182 59.4	− 5 18.1
1	197 59.6	19.1
2	212 59.8	20.0
3	228 00.0	21.0
4	243 00.1	22.0
5	258 00.3	22.9
6	273 00.5	− 5 23.9
7	288 00.7	24.8
8	303 00.9	25.8
9	318 01.0	26.8
10	333 01.2	27.7
11	348 01.4	28.7
12	3 01.6	− 5 29.6
13	18 01.8	30.6
14	33 01.9	31.5
15	48 02.1	32.5
16	63 02.3	33.5
17	78 02.5	34.4
18	93 02.6	− 5 35.4
19	108 02.8	36.3
20	123 03.0	37.3
21	138 03.2	38.2
22	153 03.4	39.2
23	168 03.5	40.2
8 0	183 03.7	− 5 41.1
1	198 03.9	42.1
2	213 04.1	43.0
3	228 04.2	44.0
4	243 04.4	44.9
5	258 04.6	45.9
6	273 04.8	− 5 46.9
7	288 04.9	47.8
8	303 05.1	48.8
9	318 05.3	49.7
10	333 05.5	50.7
11	348 05.6	51.6
12	3 05.8	− 5 52.6
13	18 06.0	53.5
14	33 06.2	54.5
15	48 06.3	55.4
16	63 06.5	56.4
17	78 06.7	57.4
18	93 06.8	− 5 58.3
19	108 07.0	5 59.3
20	123 07.2	6 00.2
21	138 07.4	01.2
22	153 07.5	02.1
23	168 07.7	03.1
9 0	183 07.9	− 6 04.0
1	198 08.0	05.0
2	213 08.2	05.9
3	228 08.4	06.9
4	243 08.6	07.8
5	258 08.7	08.8
6	273 08.9	− 6 09.7
7	288 09.1	10.7
8	303 09.2	11.7
9	318 09.4	12.6
10	333 09.6	13.6
11	348 09.8	14.5
12	3 09.9	− 6 15.5
13	18 10.1	16.4
14	33 10.3	17.4
15	48 10.4	18.3
16	63 10.6	19.3
17	78 10.8	20.2
18	93 10.9	− 6 21.2
19	108 11.1	22.1
20	123 11.3	23.1
21	138 11.4	24.0
22	153 11.6	25.0
23	168 11.8	25.9
24	183 11.9	− 6 26.9
code	—	- 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.0
5	Achernar	335 59.2	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.7	−28 54.2
10	Aldebaran	291 40.6	+16 25.2
32	Alioth	167 00.3	+56 12.6
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.7	− 1 13.6
25	Alphard	218 40.3	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.8	+ 8 44.8
2	Ankaa	353 59.2	−42 33.2
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.9	−68 57.1
22	Avior	234 36.7	−59 21.3
13	Bellatrix	279 19.9	+ 6 18.8
16	Betelg'se	271 49.7	+ 7 24.2
17	Canopus	264 16.0	−52 39.8
12	Capella	281 40.5	+45 57.2
53	Deneb	50 01.9	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.8	+61 59.9
14	Elnath	279 09.1	+28 34.3
47	Eltanin	91 07.1	+51 29.9
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.7	−56 51.3
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.2	−34 24.7
40	Kochab	137 18.6	+74 20.7
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.1	−69 31.3
9	Mirfak	309 44.2	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.4	−56 53.3
21	Pollux	244 22.4	+28 08.4
20	Procyon	245 46.6	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 54.9	− 8 14.9
38	Rigil Kent.	140 53.8	−60 39.0
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.1	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.7	−43 14.4
49	Vega	81 09.3	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 7	8	9
h	m s	m s	m s
0	+11 57.3	+12 14.5	+12 31.2
6	+12 01.7	+12 18.7	+12 35.3
12	+12 06.0	+12 22.9	+12 39.4
18	+12 10.2	+12 27.0	+12 43.4
24	+12 14.5	+12 31.2	+12 47.4

Lat.	Sunrise	Twlt. begins	Moonrise 7	8	9	10
N °	h m	h m	h m	h m	h m	h m
72	6 50	2 48	6 31	8 34	11 14	■
70	6 43	3 09	6 22	8 12	10 20	■
68	6 37	3 23	6 14	7 56	9 47	12 06
66	6 32	3 35	6 08	7 42	9 23	11 16
64	6 28	3 45	6 02	7 31	9 05	10 45
62	6 25	3 53	5 57	7 22	8 50	10 22
60	6 22	4 00	5 53	7 14	8 37	10 03
58	6 19	4 06	5 50	7 07	8 27	9 48
56	6 16	4 10	5 47	7 01	8 17	9 35
54	6 14	4 14	5 44	6 56	8 09	9 24
52	6 12	4 18	5 41	6 51	8 02	9 14
50	6 10	4 22	5 39	6 46	7 55	9 05
45	6 06	4 28	5 34	6 37	7 41	8 46
40	6 03	4 32	5 30	6 29	7 30	8 31
35	6 00	4 35	5 26	6 22	7 20	8 18
30	5 57	4 38	5 23	6 16	7 11	8 07
20	5 53	4 39	5 18	6 06	6 56	7 48
10	5 48	4 38	5 13	5 57	6 44	7 32
0	5 44	4 36	5 08	5 49	6 32	7 17
10	5 40	4 31	5 04	5 41	6 20	7 02
20	5 36	4 22	5 00	5 32	6 07	6 45
30	5 30	4 11	4 54	5 23	5 53	6 27
35	5 27	4 02	4 51	5 17	5 45	6 16
40	5 24	3 51	4 48	5 11	5 35	6 04
45	5 20	3 38	4 44	5 03	5 25	5 50
50	5 15	3 21	4 39	4 54	5 12	5 32
52	5 12	3 13	4 37	4 50	5 05	5 24
54	5 10	3 02	4 35	4 46	4 59	5 15
56	5 07	2 51	4 32	4 41	4 51	5 05
58	5 04	2 37	4 30	4 36	4 43	4 53
60	5 00	2 19	4 26	4 29	4 34	4 40
S						

Lat.	Sunset	Twlt. ends	Moonset 7	8	9	10
N °	h m	h m	h m	h m	h m	h m
72	16 44	20 39	15 38	15 02	13 51	■
70	16 51	20 20	15 50	15 25	14 47	■
68	16 57	20 06	16 00	15 43	15 21	14 37
66	17 01	19 54	16 08	15 58	15 46	15 28
64	17 06	19 46	16 15	16 10	16 05	16 00
62	17 09	19 38	16 21	16 21	16 21	16 24
60	17 12	19 31	16 26	16 30	16 34	16 43
58	17 15	19 26	16 31	16 37	16 46	16 58
56	17 18	19 22	16 35	16 44	16 56	17 12
54	17 20	19 18	16 39	16 51	17 05	17 24
52	17 22	19 14	16 42	16 56	17 13	17 34
50	17 24	19 11	16 46	17 01	17 20	17 43
45	17 28	19 05	16 52	17 12	17 35	18 03
40	17 32	19 02	16 58	17 22	17 48	18 19
35	17 35	18 59	17 03	17 30	17 59	18 33
30	17 38	18 57	17 07	17 36	18 09	18 45
20	17 42	18 55	17 15	17 49	18 25	19 05
10	17 47	18 57	17 22	17 59	18 39	19 23
0	17 51	19 00	17 28	18 09	18 53	19 39
10	17 55	19 05	17 34	18 19	19 07	19 56
20	18 00	19 14	17 41	18 30	19 21	20 14
30	18 05	19 26	17 49	18 43	19 38	20 35
35	18 09	19 36	17 53	18 50	19 48	20 47
40	18 12	19 46	17 58	18 58	19 59	21 01
45	18 17	20 00	18 04	19 08	20 12	21 18
50	18 22	20 18	18 11	19 19	20 29	21 38
52	18 24	20 27	18 15	19 25	20 36	21 48
54	18 27	20 38	18 18	19 31	20 45	21 59
56	18 30	20 50	18 22	19 38	20 54	22 12
58	18 33	21 04	18 27	19 45	21 05	22 26
60	18 37	21 23	18 32	19 54	21 18	22 44
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
7	11 18	10 08	10 01	4 42	12 45
8	11 59	10 09	9 59	4 38	12 41
9	12 42	10 09	9 58	4 35	12 38
10	13 28	10 10	9 56	4 31	12 34

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.3	0.1	0.1
30	0.3	0.1	0.0
45	0.3	0.1	0.0
60	0.3	0.0	0.0
75	0.3	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	7	8	9
°	′	′	′
0	11.7	11.9	12.1
4	11.7	11.9	12.1
8	11.8	11.9	12.2
12	11.8	11.9	12.2
16	11.9	12.0	12.2
20	12.0	12.1	12.3
24	12.0	12.2	12.4
28	12.1	12.2	12.5
32	12.2	12.4	12.6
36	12.4	12.5	12.7
40	12.5	12.6	12.8
44	12.6	12.7	12.9
48	12.8	12.9	13.1
52	13.0	13.1	13.2
56	13.1	13.2	13.4
60	13.3	13.4	13.5
64	13.5	13.6	13.7
68	13.7	13.8	13.9
72	13.9	14.0	14.1
76	14.1	14.2	14.3
80	14.3	14.4	14.4
84	14.5	14.6	14.6
88	14.7	14.7	14.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	7	8	9
°	′	′	′
0	17.7	17.7	17.5
4	17.7	17.6	17.5
8	17.7	17.6	17.5
12	17.6	17.6	17.4
16	17.6	17.5	17.4
20	17.5	17.5	17.3
24	17.4	17.4	17.2
28	17.3	17.3	17.2
32	17.2	17.2	17.1
36	17.1	17.0	16.9
40	17.0	16.9	16.8
44	16.8	16.8	16.7
48	16.7	16.6	16.6
52	16.5	16.5	16.4
56	16.3	16.3	16.2
60	16.1	16.1	16.1
64	16.0	15.9	15.9
68	15.8	15.8	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	14.9	15.0	15.0
88	14.8	14.8	14.9
90			

Subtract from table, back cover

New Moon 8

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
10 h 0	18 18.1	207 33.5	+ 5 28.3	210 47.7	+ 6 42.6	292 10.2	+22 48.8	171 02.1	− 8 50.0	164 18.6	134	−18 52.6	− 96
1	33 20.5	222 33.1	27.2	225 48.8	42.0	307 12.6	48.8	186 04.3	50.1	178 51.0	133	19 02.2	− 94
2	48 23.0	237 32.7	26.0	240 49.8	41.4	322 15.0	48.8	201 06.4	50.2	193 23.3	132	19 11.6	− 94
3	63 25.5	252 32.3	•• 24.9	255 50.8	•• 40.8	337 17.5	•• 48.8	216 08.6	•• 50.4	207 55.5	131	•19 21.0	− 93
4	78 27.9	267 31.9	23.7	270 51.8	40.2	352 19.9	48.8	231 10.8	50.5	222 27.6	131	19 30.3	− 93
5	93 30.4	282 31.5	22.5	285 52.8	39.6	7 22.3	48.8	246 13.0	50.6	236 59.7	130	19 39.6	− 91
6	108 32.9	297 31.1	+ 5 21.4	300 53.8	+ 6 39.0	22 24.7	+22 48.8	261 15.2	− 8 50.7	251 31.7	130	−19 48.7	− 91
7	123 35.3	312 30.7	20.2	315 54.8	38.4	37 27.1	48.8	276 17.4	50.8	266 03.7	128	19 57.8	− 90
8	138 37.8	327 30.3	19.1	330 55.8	37.7	52 29.5	48.8	291 19.5	50.9	280 35.5	128	20 06.8	− 89
9	153 40.2	342 29.9	•• 17.9	345 56.8	•• 37.1	67 32.0	•• 48.8	306 21.7	•• 51.0	295 07.3	127	•20 15.7	− 88
10	168 42.7	357 29.5	16.8	0 57.8	36.5	82 34.4	48.8	321 23.9	51.1	309 39.0	127	20 24.5	− 87
11	183 45.2	12 29.1	15.6	15 58.9	35.9	97 36.8	48.8	336 26.1	51.2	324 10.7	126	20 33.2	− 86
12	198 47.6	27 28.7	+ 5 14.5	30 59.9	+ 6 35.3	112 39.2	+22 48.8	351 28.3	− 8 51.3	338 42.3	125	−20 41.8	− 86
13	213 50.1	42 28.4	13.3	46 00.9	34.7	127 41.7	48.8	6 30.4	51.4	353 13.8	124	20 50.4	− 84
14	228 52.6	57 28.0	12.2	61 01.9	34.1	142 44.1	48.8	21 32.6	51.5	7 45.2	124	20 58.8	− 84
15	243 55.0	72 27.6	•• 11.0	76 02.9	•• 33.5	157 46.5	•• 48.8	36 34.8	•• 51.6	22 16.6	123	•21 07.2	− 83
16	258 57.5	87 27.2	09.8	91 03.9	32.9	172 48.9	48.8	51 37.0	51.7	36 47.9	122	21 15.5	− 82
17	274 00.0	102 26.8	08.7	106 04.9	32.3	187 51.4	48.8	66 39.2	51.9	51 19.1	122	21 23.7	− 81
18	289 02.4	117 26.4	+ 5 07.5	121 05.9	+ 6 31.7	202 53.8	+22 48.8	81 41.4	− 8 52.0	65 50.3	121	−21 31.8	− 80
19	304 04.9	132 26.0	06.4	136 06.9	31.1	217 56.2	48.8	96 43.5	52.1	80 21.4	120	21 39.8	− 79
20	319 07.3	147 25.6	05.2	151 07.9	30.5	232 58.6	48.8	111 45.7	52.2	94 52.4	119	21 47.7	− 78
21	334 09.8	162 25.2	•• 04.0	166 09.0	•• 29.9	248 01.1	•• 48.8	126 47.9	•• 52.3	109 23.3	119	•21 55.5	− 77
22	349 12.3	177 24.8	02.9	181 10.0	29.3	263 03.5	48.8	141 50.1	52.4	123 54.2	117	22 03.2	− 76
23	4 14.7	192 24.4	01.7	196 11.0	28.6	278 05.9	48.8	156 52.3	52.5	138 24.9	118	22 10.8	− 75
11 0	19 17.2	207 24.0	+ 5 00.6	211 12.0	+ 6 28.0	293 08.3	+22 48.8	171 54.4	− 8 52.6	152 55.7	116	−22 18.3	− 74
1	34 19.7	222 23.6	4 59.4	226 13.0	27.4	308 10.8	48.8	186 56.6	52.7	167 26.3	116	22 25.7	− 73
2	49 22.1	237 23.2	58.2	241 14.0	26.8	323 13.2	48.8	201 58.8	52.8	181 56.9	115	22 33.0	− 72
3	64 24.6	252 22.8	•• 57.1	256 15.0	•• 26.2	338 15.6	•• 48.8	217 01.0	•• 52.9	196 27.4	114	•22 40.2	− 71
4	79 27.1	267 22.4	55.9	271 16.0	25.6	353 18.0	48.8	232 03.2	53.0	210 57.8	114	22 47.3	− 70
5	94 29.5	282 22.0	54.8	286 17.1	25.0	8 20.5	48.8	247 05.4	53.1	225 28.2	113	22 54.3	− 69
6	109 32.0	297 21.6	+ 4 53.6	301 18.1	+ 6 24.4	23 22.9	+22 48.8	262 07.5	− 8 53.3	239 58.5	112	−23 01.2	− 68
7	124 34.5	312 21.2	52.4	316 19.1	23.8	38 25.3	48.8	277 09.7	53.4	254 28.7	111	23 08.0	− 67
8	139 36.9	327 20.9	51.3	331 20.1	23.2	53 27.8	48.8	292 11.9	53.5	268 58.8	111	23 14.7	− 66
9	154 39.4	342 20.5	•• 50.1	346 21.1	•• 22.6	68 30.2	•• 48.8	307 14.1	•• 53.6	283 28.9	110	•23 21.3	− 64
10	169 41.8	357 20.1	49.0	1 22.1	22.0	83 32.6	48.8	322 16.3	53.7	297 58.9	109	23 27.7	− 64
11	184 44.3	12 19.7	47.8	16 23.1	21.4	98 35.0	48.8	337 18.4	53.8	312 28.8	109	23 34.1	− 62
12	199 46.8	27 19.3	+ 4 46.6	31 24.1	+ 6 20.7	113 37.5	+22 48.8	352 20.6	− 8 53.9	326 58.7	108	−23 40.3	− 62
13	214 49.2	42 18.9	45.5	46 25.1	20.1	128 39.9	48.8	7 22.8	54.0	341 28.5	107	23 46.5	− 60
14	229 51.7	57 18.5	44.3	61 26.2	19.5	143 42.3	48.8	22 25.0	54.1	355 58.2	107	23 52.5	− 59
15	244 54.2	72 18.1	•• 43.1	76 27.2	•• 18.9	158 44.8	•• 48.8	37 27.2	•• 54.2	10 27.9	106	•23 58.4	− 58
16	259 56.6	87 17.7	42.0	91 28.2	18.3	173 47.2	48.8	52 29.4	54.3	24 57.5	105	24 04.2	− 57
17	274 59.1	102 17.3	40.8	106 29.2	17.7	188 49.6	48.8	67 31.5	54.4	39 27.0	104	24 09.9	− 56
18	290 01.6	117 16.9	+ 4 39.7	121 30.2	+ 6 17.1	203 52.1	+22 48.8	82 33.7	− 8 54.5	53 56.4	104	−24 15.5	− 54
19	305 04.0	132 16.5	38.5	136 31.2	16.5	218 54.5	48.8	97 35.9	54.6	68 25.8	103	24 20.9	− 54
20	320 06.5	147 16.1	37.3	151 32.2	15.9	233 56.9	48.8	112 38.1	54.8	82 55.1	103	24 26.3	− 52
21	335 09.0	162 15.7	•• 36.2	166 33.2	•• 15.3	248 59.4	•• 48.8	127 40.3	•• 54.9	97 24.4	102	•24 31.5	− 51
22	350 11.4	177 15.4	35.0	181 34.3	14.7	264 01.8	48.8	142 42.4	55.0	111 53.6	101	24 36.6	− 50
23	5 13.9	192 15.0	33.8	196 35.3	14.1	279 04.2	48.8	157 44.6	55.1	126 22.7	101	24 41.6	− 49
12 0	20 16.3	207 14.6	+ 4 32.7	211 36.3	+ 6 13.5	294 06.7	+22 48.8	172 46.8	− 8 55.2	140 51.8	100	−24 46.5	− 47
1	35 18.8	222 14.2	31.5	226 37.3	12.8	309 09.1	48.8	187 49.0	55.3	155 20.8	99	24 51.2	− 46
2	50 21.3	237 13.8	30.3	241 38.3	12.2	324 11.6	48.8	202 51.2	55.4	169 49.7	99	24 55.8	− 45
3	65 23.7	252 13.4	•• 29.2	256 39.3	•• 11.6	339 14.0	•• 48.8	217 53.3	•• 55.5	184 18.6	98	•25 00.3	− 44
4	80 26.2	267 13.0	28.0	271 40.3	11.0	354 16.4	48.8	232 55.5	55.6	198 47.4	97	25 04.7	− 42
5	95 28.7	282 12.6	26.8	286 41.4	10.4	9 18.9	48.8	247 57.7	55.7	213 16.1	97	25 08.9	− 42
6	110 31.1	297 12.2	+ 4 25.7	301 42.4	+ 6 09.8	24 21.3	+22 48.8	262 59.9	− 8 55.8	227 44.8	96	−25 13.1	− 40
7	125 33.6	312 11.8	24.5	316 43.4	09.2	39 23.7	48.8	278 02.1	55.9	242 13.4	96	25 17.1	− 38
8	140 36.1	327 11.4	23.3	331 44.4	08.6	54 26.2	48.8	293 04.2	56.0	256 42.0	95	25 20.9	− 38
9	155 38.5	342 11.0	•• 22.1	346 45.4	•• 08.0	69 28.6	•• 48.9	308 06.4	•• 56.2	271 10.5	95	•25 24.7	− 36
10	170 41.0	357 10.7	21.0	1 46.4	07.4	84 31.1	48.9	323 08.6	56.3	285 39.0	93	25 28.3	− 35
11	185 43.5	12 10.3	19.8	16 47.4	06.8	99 33.5	48.9	338 10.8	56.4	300 07.3	94	25 31.8	− 33
12	200 45.9	27 09.9	+ 4 18.6	31 48.5	+ 6 06.1	114 35.9	+22 48.9	353 13.0	− 8 56.5	314 35.7	93	−25 35.1	− 33
13	215 48.4	42 09.5	17.5	46 49.5	05.5	129 38.4	48.9	8 15.2	56.6	329 04.0	92	25 38.4	− 31
14	230 50.8	57 09.1	16.3	61 50.5	04.9	144 40.8	48.9	23 17.3	56.7	343 32.2	92	25 41.5	− 29
15	245 53.3	72 08.7	•• 15.1	76 51.5	•• 04.3	159 43.3	•• 48.9	38 19.5	•• 56.8	358 00.4	91	•25 44.4	− 29
16	260 55.8	87 08.3	14.0	91 52.5	03.7	174 45.7	48.9	53 21.7	56.9	12 28.5	91	25 47.3	− 27
17	275 58.2	102 07.9	12.8	106 53.5	03.1	189 48.1	48.9	68 23.9	57.0	26 56.6	90	25 50.0	− 25
18	291 00.7	117 07.5	+ 4 11.6	121 54.5	+ 6 02.5	204 50.6	+22 48.9	83 26.1	− 8 57.1	41 24.6	90	−25 52.5	− 25
19	306 03.2	132 07.1	10.4	136 55.6	01.9	219 53.0	48.9	98 28.2	57.2	55 52.6	89	25 55.0	− 23
20	321 05.6	147 06.8	09.3	151 56.6	01.3	234 55.5	48.9	113 30.4	57.3	70 20.5	89	25 57.3	− 21
21	336 08.1	162 06.4	•• 08.1	166 57.6	•• 00.7	249 57.9	•• 48.9	128 32.6	•• 57.4	84 48.4	88	•25 59.4	− 21
22	351 10.6	177 06.0	06.9	181 58.6	6 00.1	265 00.4	48.9	143 34.8	57.5	99 16.2	88	26 01.5	− 18
23	6 13.0	192 05.6	05.8	196 59.6	5 59.4	280 02.8	48.9	158 37.0	57.7	113 44.0	87	26 03.3	− 18
24	21 15.5	207 05.2	+ 4 04.6	212 00.6	+ 5 58.8	295 05.3	+22 48.9	173 39.1	− 8 57.8	128 11.7	87	−26 05.1	− 16
code	—	− 4	− 11	+ 10	− 6	+ 24	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
10 h 0	183 11.9	− 6 26.9
1	198 12.1	27.8
2	213 12.3	28.8
3	228 12.4	29.7
4	243 12.6	30.7
5	258 12.8	31.6
6	273 12.9	− 6 32.6
7	288 13.1	33.5
8	303 13.3	34.5
9	318 13.4	35.4
10	333 13.6	36.4
11	348 13.8	37.3
12	3 13.9	− 6 38.2
13	18 14.1	39.2
14	33 14.3	40.1
15	48 14.4	41.1
16	63 14.6	42.0
17	78 14.8	43.0
18	93 14.9	− 6 43.9
19	108 15.1	44.9
20	123 15.2	45.8
21	138 15.4	46.8
22	153 15.6	47.7
23	168 15.7	48.7
11 h 0	183 15.9	− 6 49.6
1	198 16.1	50.6
2	213 16.2	51.5
3	228 16.4	52.4
4	243 16.5	53.4
5	258 16.7	54.3
6	273 16.9	− 6 55.3
7	288 17.0	56.2
8	303 17.2	57.2
9	318 17.3	58.1
10	333 17.5	6 59.1
11	348 17.7	7 00.0
12	3 17.8	− 7 00.9
13	18 18.0	01.9
14	33 18.1	02.8
15	48 18.3	03.8
16	63 18.5	04.7
17	78 18.6	05.7
18	93 18.8	− 7 06.6
19	108 18.9	07.6
20	123 19.1	08.5
21	138 19.3	09.4
22	153 19.4	10.4
23	168 19.6	11.3
12 h 0	183 19.7	− 7 12.3
1	198 19.9	13.2
2	213 20.0	14.1
3	228 20.2	15.1
4	243 20.4	16.0
5	258 20.5	17.0
6	273 20.7	− 7 17.9
7	288 20.8	18.9
8	303 21.0	19.8
9	318 21.1	20.7
10	333 21.3	21.7
11	348 21.4	22.6
12	3 21.6	− 7 23.6
13	18 21.8	24.5
14	33 21.9	25.4
15	48 22.1	26.4
16	63 22.2	27.3
17	78 22.4	28.3
18	93 22.5	− 7 29.2
19	108 22.7	30.1
20	123 22.8	31.1
21	138 23.0	32.0
22	153 23.1	32.9
23	168 23.3	33.9
24	183 23.4	− 7 34.8
code	—	− 10

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.8	−40 29.0
5	Achernar	335 59.2	−57 28.0
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.7	−28 54.2
10	Aldebaran	291 40.6	+16 25.2
32	Alioth	167 00.3	+56 12.6
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.7	− 1 13.6
25	Alphard	218 40.2	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.2	−42 33.3
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.9	−68 57.0
22	Avior	234 36.7	−59 21.3
13	Bellatrix	279 19.9	+ 6 18.8
16	Betelg'se	271 49.6	+ 7 24.2
17	Canopus	264 15.9	−52 39.8
12	Capella	281 40.4	+45 57.2
53	Deneb	50 01.9	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.8	+61 59.9
14	Elnath	279 09.1	+28 34.3
47	Eltanin	91 07.1	+51 29.8
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.6	−56 51.2
29	Gienah	176 38.8	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.6	+74 20.7
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.0	−69 31.3
9	Mirfak	309 44.2	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.4	−56 53.3
21	Pollux	244 22.4	+28 08.4
20	Procyon	245 46.6	+ 5 20.8
46	R'alhague	96 48.1	+12 35.6
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 54.9	− 8 14.9
38	Rigil Kent.	140 53.8	−60 39.0
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.1	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.7	−43 14.4
49	Vega	81 09.4	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.−Mean) 10	11	12
h	m s	m s	m s
0	+12 47.4	+13 03.3	+13 18.6
6	+12 51.4	+13 07.1	+13 22.4
12	+12 55.4	+13 11.0	+13 26.1
18	+12 59.3	+13 14.8	+13 29.8
24	+13 03.3	+13 18.6	+13 33.5

Lat.	Sunrise	Twlt. begins	Moonrise 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	7 04	3 06	▬	▬	▬	▬
70	6 55	3 23	▬	▬	▬	▬
68	6 48	3 36	12 06	▬	▬	▬
66	6 42	3 46	11 16	13 58	▬	▬
64	6 37	3 55	10 45	12 33	14 39	▬
62	6 33	4 02	10 22	11 56	13 25	14 34
60	6 29	4 07	10 03	11 29	12 50	13 54
58	6 25	4 12	9 48	11 09	12 24	13 26
56	6 22	4 16	9 35	10 52	12 04	13 05
54	6 20	4 20	9 24	10 38	11 47	12 47
52	6 17	4 24	9 14	10 25	11 33	12 32
50	6 15	4 27	9 05	10 14	11 20	12 19
45	6 10	4 32	8 46	9 51	10 54	11 52
40	6 06	4 35	8 31	9 33	10 34	11 31
35	6 02	4 38	8 18	9 18	10 17	11 13
30	5 59	4 40	8 07	9 05	10 02	10 58
20	5 53	4 40	7 48	8 42	9 37	10 32
10	5 48	4 38	7 32	8 23	9 16	10 10
0	5 44	4 35	7 17	8 05	8 56	9 49
10	5 39	4 28	7 02	7 47	8 36	9 28
20	5 33	4 20	6 45	7 28	8 15	9 06
30	5 27	4 06	6 27	7 06	7 50	8 40
35	5 23	3 57	6 16	6 53	7 36	8 25
40	5 19	3 46	6 04	6 38	7 19	8 08
45	5 14	3 32	5 50	6 21	6 59	7 47
50	5 08	3 13	5 32	5 59	6 34	7 20
52	5 06	3 04	5 24	5 49	6 22	7 07
54	5 03	2 53	5 15	5 37	6 09	6 53
56	4 59	2 40	5 05	5 24	5 53	6 35
58	4 56	2 24	4 53	5 09	5 34	6 14
60 S	4 51	2 04	4 40	4 51	5 11	5 48

Lat.	Sunset	Twlt. ends	Moonset 10	11	12	13
N °	h m	h m	h m	h m	h m	h m
72	16 28	20 20	▬	▬	▬	▬
70	16 37	20 05	▬	▬	▬	▬
68	16 44	19 52	14 37	▬	▬	▬
66	16 50	19 42	15 28	14 27	▬	▬
64	16 55	19 34	16 00	15 52	15 33	▬
62	17 00	19 28	16 24	16 30	16 47	17 31
60	17 04	19 23	16 43	16 57	17 23	18 11
58	17 07	19 18	16 58	17 18	17 49	18 38
56	17 10	19 14	17 12	17 35	18 09	19 00
54	17 13	19 11	17 24	17 50	18 27	19 18
52	17 15	19 07	17 34	18 02	18 41	19 33
50	17 18	19 05	17 43	18 14	18 54	19 46
45	17 23	19 00	18 03	18 37	19 20	20 13
40	17 27	18 57	18 19	18 56	19 41	20 34
35	17 31	18 55	18 33	19 12	19 58	20 52
30	17 34	18 53	18 45	19 26	20 13	21 07
20	17 40	18 53	19 05	19 49	20 39	21 32
10	17 45	18 55	19 23	20 10	21 01	21 55
0	17 50	18 59	19 39	20 29	21 21	22 15
10	17 55	19 06	19 56	20 48	21 41	22 36
20	18 01	19 16	20 14	21 08	22 03	22 58
30	18 07	19 29	20 35	21 32	22 29	23 23
35	18 11	19 38	20 47	21 46	22 44	23 38
40	18 15	19 50	21 01	22 02	23 01	23 56
45	18 20	20 04	21 18	22 22	23 22	24 16
50	18 26	20 24	21 38	22 46	23 49	24 43
52	18 29	20 34	21 48	22 58	24 02	0 02
54	18 32	20 45	21 59	23 11	24 16	0 16
56	18 36	20 59	22 12	23 26	24 33	0 33
58	18 40	21 16	22 26	23 45	24 54	0 54
60 S	18 44	21 36	22 44	24 08	0 08	1 21

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
10	13 28	10 10	9 56	4 31	12 34
11	14 17	10 11	9 55	4 27	12 31
12	15 08	10 11	9 53	4 23	12 27
13	16 02	10 12	9 51	4 19	12 24

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	10	11	12
°	′	′	′
0	12.4	12.9	13.5
4	12.4	12.9	13.5
8	12.4	12.9	13.5
12	12.4	12.9	13.6
16	12.5	13.0	13.6
20	12.6	13.0	13.6
24	12.6	13.1	13.7
28	12.7	13.2	13.7
32	12.8	13.2	13.8
36	12.9	13.3	13.9
40	13.0	13.4	13.9
44	13.1	13.5	14.0
48	13.3	13.6	14.1
52	13.4	13.7	14.2
56	13.5	13.9	14.3
60	13.7	14.0	14.4
64	13.9	14.1	14.5
68	14.0	14.3	14.6
72	14.2	14.4	14.7
76	14.4	14.5	14.8
80	14.5	14.7	14.9
84	14.7	14.8	15.0
88	14.8	14.9	15.1
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	10	11	12
°	′	′	′
0	17.4	17.1	16.7
4	17.4	17.1	16.7
8	17.3	17.0	16.7
12	17.3	17.0	16.7
16	17.2	17.0	16.6
20	17.2	16.9	16.6
24	17.1	16.9	16.6
28	17.0	16.8	16.5
32	16.9	16.7	16.4
36	16.8	16.6	16.4
40	16.7	16.5	16.3
44	16.6	16.4	16.2
48	16.5	16.3	16.1
52	16.3	16.2	16.1
56	16.2	16.1	16.0
60	16.0	16.0	15.9
64	15.9	15.8	15.8
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.3	15.3
84	15.0	15.1	15.2
88	14.9	15.0	15.1
90			

Subtract from table, back cover

Columbus Day 12

GMT	♈ GHA	VENUS −3.4 GHA	VENUS −3.4 Dec.	MARS 2.0 GHA	MARS 2.0 Dec.	JUPITER −2.1 GHA	JUPITER −2.1 Dec.	SATURN 0.9 GHA	SATURN 0.9 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
13 0	21 15.5	207 05.2	+ 4 04.6	212 00.6	+ 5 58.8	295 05.3	+22 48.9	173 39.1	− 8 57.8	128 11.7	87	−26 05.1	− 16
1	36 17.9	222 04.8	03.4	227 01.6	58.2	310 07.7	48.9	188 41.3	57.9	142 39.4	86	26 06.7	− 15
2	51 20.4	237 04.4	02.2	242 02.7	57.6	325 10.1	48.9	203 43.5	58.0	157 07.0	87	26 08.2	− 13
3	66 22.9	252 04.0	4 01.1	257 03.7	57.0	340 12.6	48.9	218 45.7	58.1	171 34.7	85	−26 09.5	− 12
4	81 25.3	267 03.6	3 59.9	272 04.7	56.4	355 15.0	48.9	233 47.9	58.2	186 02.2	86	26 10.7	− 11
5	96 27.8	282 03.2	58.7	287 05.7	55.8	10 17.5	48.9	248 50.0	58.3	200 29.8	85	26 11.8	− 9
6	111 30.3	297 02.9	+ 3 57.5	302 06.7	+ 5 55.2	25 19.9	+22 48.9	263 52.2	− 8 58.4	214 57.3	84	−26 12.7	− 8
7	126 32.7	312 02.5	56.4	317 07.7	54.6	40 22.4	48.9	278 54.4	58.5	229 24.7	84	26 13.5	− 6
8	141 35.2	327 02.1	55.2	332 08.7	54.0	55 24.8	48.9	293 56.6	58.6	243 52.1	84	26 14.1	− 5
9	156 37.7	342 01.7	54.0	347 09.8	53.3	70 27.3	48.9	308 58.8	58.7	258 19.5	84	−26 14.6	− 4
10	171 40.1	357 01.3	52.8	2 10.8	52.7	85 29.7	48.9	324 00.9	58.8	272 46.9	83	26 15.0	− 2
11	186 42.6	12 00.9	51.7	17 11.8	52.1	100 32.2	48.9	339 03.1	58.9	287 14.2	83	26 15.2	− 1
12	201 45.1	27 00.5	+ 3 50.5	32 12.8	+ 5 51.5	115 34.6	+22 48.9	354 05.3	− 8 59.1	301 41.5	82	−26 15.3	+ 1
13	216 47.5	42 00.1	49.3	47 13.8	50.9	130 37.1	48.9	9 07.5	59.2	316 08.7	83	26 15.2	+ 2
14	231 50.0	56 59.7	48.1	62 14.8	50.3	145 39.5	48.9	24 09.7	59.3	330 36.0	82	26 15.0	+ 4
15	246 52.4	71 59.4	47.0	77 15.9	49.7	160 42.0	48.9	39 11.8	59.4	345 03.2	82	−26 14.6	+ 5
16	261 54.9	86 59.0	45.8	92 16.9	49.1	175 44.4	48.9	54 14.0	59.5	359 30.4	81	26 14.1	+ 7
17	276 57.4	101 58.6	44.6	107 17.9	48.5	190 46.9	48.9	69 16.2	59.6	13 57.5	81	26 13.4	+ 8
18	291 59.8	116 58.2	+ 3 43.4	122 18.9	+ 5 47.9	205 49.3	+22 48.9	84 18.4	− 8 59.7	28 24.6	81	−26 12.6	+ 9
19	307 02.3	131 57.8	42.3	137 19.9	47.3	220 51.8	48.9	99 20.6	59.8	42 51.7	81	26 11.7	+ 11
20	322 04.8	146 57.4	41.1	152 20.9	46.6	235 54.2	48.9	114 22.7	8 59.9	57 18.8	81	26 10.6	+ 12
21	337 07.2	161 57.0	39.9	167 22.0	46.0	250 56.7	48.9	129 24.9	9 00.0	71 45.9	80	−26 09.4	+ 14
22	352 09.7	176 56.6	38.7	182 23.0	45.4	265 59.1	48.9	144 27.1	00.1	86 12.9	81	26 08.0	+ 15
23	7 12.2	191 56.3	37.5	197 24.0	44.8	281 01.6	48.9	159 29.3	00.2	100 40.0	80	26 06.5	+ 17
14 0	22 14.6	206 55.9	+ 3 36.4	212 25.0	+ 5 44.2	296 04.0	+22 48.9	174 31.5	− 9 00.3	115 07.0	80	−26 04.8	+ 18
1	37 17.1	221 55.5	35.2	227 26.0	43.6	311 06.5	48.9	189 33.6	00.4	129 34.0	79	26 03.0	+ 19
2	52 19.6	236 55.1	34.0	242 27.0	43.0	326 08.9	48.9	204 35.8	00.6	144 00.9	80	26 01.1	+ 22
3	67 22.0	251 54.7	32.8	257 28.1	42.4	341 11.4	48.9	219 38.0	00.7	158 27.9	80	−25 58.9	+ 22
4	82 24.5	266 54.3	31.6	272 29.1	41.8	356 13.9	48.9	234 40.2	00.8	172 54.9	79	25 56.7	+ 24
5	97 26.9	281 53.9	30.5	287 30.1	41.1	11 16.3	48.9	249 42.4	00.9	187 21.8	79	25 54.3	+ 26
6	112 29.4	296 53.5	+ 3 29.3	302 31.1	+ 5 40.5	26 18.8	+22 48.9	264 44.5	− 9 01.0	201 48.7	80	−25 51.7	+ 27
7	127 31.9	311 53.2	28.1	317 32.1	39.9	41 21.2	48.9	279 46.7	01.1	216 15.7	79	25 49.0	+ 28
8	142 34.3	326 52.8	26.9	332 33.1	39.3	56 23.7	48.9	294 48.9	01.2	230 42.6	79	25 46.2	+ 30
9	157 36.8	341 52.4	25.7	347 34.2	38.7	71 26.1	48.9	309 51.1	01.3	245 09.5	79	−25 43.2	+ 31
10	172 39.3	356 52.0	24.6	2 35.2	38.1	86 28.6	48.9	324 53.3	01.4	259 36.4	79	25 40.1	+ 33
11	187 41.7	11 51.6	23.4	17 36.2	37.5	101 31.1	48.9	339 55.4	01.5	274 03.3	79	25 36.8	+ 34
12	202 44.2	26 51.2	+ 3 22.2	32 37.2	+ 5 36.9	116 33.5	+22 48.9	354 57.6	− 9 01.6	288 30.2	79	−25 33.4	+ 36
13	217 46.7	41 50.8	21.0	47 38.2	36.3	131 36.0	48.9	9 59.8	01.7	302 57.1	79	25 29.8	+ 37
14	232 49.1	56 50.4	19.8	62 39.3	35.6	146 38.4	48.9	25 02.0	01.8	317 24.0	79	25 26.1	+ 39
15	247 51.6	71 50.1	18.7	77 40.3	35.0	161 40.9	48.9	40 04.2	02.0	331 50.9	79	−25 22.2	+ 40
16	262 54.0	86 49.7	17.5	92 41.3	34.4	176 43.4	48.9	55 06.3	02.1	346 17.8	79	25 18.2	+ 42
17	277 56.5	101 49.3	16.3	107 42.3	33.8	191 45.8	48.9	70 08.5	02.2	0 44.7	79	25 14.0	+ 43
18	292 59.0	116 48.9	+ 3 15.1	122 43.3	+ 5 33.2	206 48.3	+22 48.9	85 10.7	− 9 02.3	15 11.6	80	−25 09.7	+ 44
19	308 01.4	131 48.5	13.9	137 44.3	32.6	221 50.7	48.9	100 12.9	02.4	29 38.6	79	25 05.3	+ 46
20	323 03.9	146 48.1	12.7	152 45.4	32.0	236 53.2	48.9	115 15.1	02.5	44 05.5	79	25 00.7	+ 48
21	338 06.4	161 47.7	11.6	167 46.4	31.4	251 55.7	48.9	130 17.2	02.6	58 32.4	80	−24 55.9	+ 49
22	353 08.8	176 47.4	10.4	182 47.4	30.8	266 58.1	48.9	145 19.4	02.7	72 59.4	79	24 51.0	+ 50
23	8 11.3	191 47.0	09.2	197 48.4	30.1	282 00.6	48.9	160 21.6	02.8	87 26.3	80	24 46.0	+ 52
15 0	23 13.8	206 46.6	+ 3 08.0	212 49.4	+ 5 29.5	297 03.0	+22 48.9	175 23.8	− 9 02.9	101 53.3	79	−24 40.8	+ 53
1	38 16.2	221 46.2	06.8	227 50.5	28.9	312 05.5	48.9	190 26.0	03.0	116 20.2	80	24 35.5	+ 55
2	53 18.7	236 45.8	05.6	242 51.5	28.3	327 08.0	48.9	205 28.1	03.1	130 47.2	80	24 30.0	+ 56
3	68 21.2	251 45.4	04.5	257 52.5	27.7	342 10.4	48.9	220 30.3	03.2	145 14.2	80	−24 24.4	+ 58
4	83 23.6	266 45.0	03.3	272 53.5	27.1	357 12.9	48.9	235 32.5	03.3	159 41.2	81	24 18.6	+ 59
5	98 26.1	281 44.6	02.1	287 54.5	26.5	12 15.4	48.9	250 34.7	03.5	174 08.3	80	24 12.7	+ 60
6	113 28.5	296 44.3	+ 3 00.9	302 55.5	+ 5 25.9	27 17.8	+22 48.9	265 36.9	− 9 03.6	188 35.3	81	−24 06.7	+ 62
7	128 31.0	311 43.9	2 59.7	317 56.6	25.3	42 20.3	48.9	280 39.0	03.7	203 02.4	80	24 00.5	+ 64
8	143 33.5	326 43.5	58.5	332 57.6	24.6	57 22.8	48.9	295 41.2	03.8	217 29.4	81	23 54.1	+ 64
9	158 35.9	341 43.1	57.3	347 58.6	24.0	72 25.2	48.9	310 43.4	03.9	231 56.5	82	−23 47.7	+ 66
10	173 38.4	356 42.7	56.2	2 59.6	23.4	87 27.7	48.9	325 45.6	04.0	246 23.7	81	23 41.1	+ 68
11	188 40.9	11 42.3	55.0	18 00.6	22.8	102 30.2	48.9	340 47.8	04.1	260 50.8	81	23 34.3	+ 69
12	203 43.3	26 41.9	+ 2 53.8	33 01.7	+ 5 22.2	117 32.6	+22 48.9	355 49.9	− 9 04.2	275 17.9	82	−23 27.4	+ 70
13	218 45.8	41 41.6	52.6	48 02.7	21.6	132 35.1	48.9	10 52.1	04.3	289 45.1	82	23 20.4	+ 72
14	233 48.3	56 41.2	51.4	63 03.7	21.0	147 37.6	48.9	25 54.3	04.4	304 12.3	83	23 13.2	+ 73
15	248 50.7	71 40.8	50.2	78 04.7	20.4	162 40.0	48.9	40 56.5	04.5	318 39.6	82	−23 05.9	+ 75
16	263 53.2	86 40.4	49.0	93 05.7	19.7	177 42.5	48.9	55 58.7	04.6	333 06.8	83	22 58.4	+ 76
17	278 55.7	101 40.0	47.9	108 06.8	19.1	192 45.0	48.9	71 00.8	04.7	347 34.1	83	22 50.8	+ 77
18	293 58.1	116 39.6	+ 2 46.7	123 07.8	+ 5 18.5	207 47.4	+22 48.9	86 03.0	− 9 04.8	2 01.4	83	−22 43.1	+ 79
19	309 00.6	131 39.3	45.5	138 08.8	17.9	222 49.9	48.9	101 05.2	05.0	16 28.7	83	22 35.2	+ 80
20	324 03.0	146 38.9	44.3	153 09.8	17.3	237 52.4	48.9	116 07.4	05.1	30 56.0	84	22 27.2	+ 81
21	339 05.5	161 38.5	43.1	168 10.8	16.7	252 54.9	48.9	131 09.5	05.2	45 23.4	84	−22 19.1	+ 83
22	354 08.0	176 38.1	41.9	183 11.9	16.1	267 57.3	48.9	146 11.7	05.3	59 50.8	84	22 10.8	+ 84
23	9 10.4	191 37.7	40.7	198 12.9	15.5	282 59.8	48.9	161 13.9	05.4	74 18.2	85	22 02.4	+ 86
24	24 12.9	206 37.3	+ 2 39.5	213 13.9	+ 5 14.9	298 02.3	+22 48.9	176 16.1	− 9 05.5	88 45.7	85	−21 53.8	+ 87
code	—	− 4	− 12	+ 10	− 6	+ 25	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
13 0	183 23.4	− 7 34.8
1	198 23.6	35.8
2	213 23.8	36.7
3	228 23.9	37.6
4	243 24.1	38.6
5	258 24.2	39.5
6	273 24.4	− 7 40.4
7	288 24.5	41.4
8	303 24.7	42.3
9	318 24.8	43.2
10	333 25.0	44.2
11	348 25.1	45.1
12	3 25.3	− 7 46.1
13	18 25.4	47.0
14	33 25.6	47.9
15	48 25.7	48.9
16	63 25.9	49.8
17	78 26.0	50.7
18	93 26.2	− 7 51.7
19	108 26.3	52.6
20	123 26.4	53.5
21	138 26.6	54.5
22	153 26.7	55.4
23	168 26.9	56.3
14 0	183 27.0	− 7 57.3
1	198 27.2	58.2
2	213 27.3	7 59.1
3	228 27.5	− 8 00.1
4	243 27.6	01.0
5	258 27.8	01.9
6	273 27.9	− 8 02.9
7	288 28.1	03.8
8	303 28.2	04.7
9	318 28.4	05.7
10	333 28.5	06.6
11	348 28.6	07.5
12	3 28.8	− 8 08.4
13	18 28.9	09.4
14	33 29.1	10.3
15	48 29.2	11.2
16	63 29.4	12.2
17	78 29.5	13.1
18	93 29.6	− 8 14.0
19	108 29.8	15.0
20	123 29.9	15.9
21	138 30.1	16.8
22	153 30.2	17.7
23	168 30.4	18.7
15 0	183 30.5	− 8 19.6
1	198 30.6	20.5
2	213 30.8	21.5
3	228 30.9	22.4
4	243 31.1	23.3
5	258 31.2	24.2
6	273 31.3	− 8 25.2
7	288 31.5	26.1
8	303 31.6	27.0
9	318 31.8	27.9
10	333 31.9	28.9
11	348 32.0	29.8
12	3 32.2	− 8 30.7
13	18 32.3	31.7
14	33 32.5	32.6
15	48 32.6	33.5
16	63 32.7	34.4
17	78 32.9	35.4
18	93 33.0	− 8 36.3
19	108 33.1	37.2
20	123 33.3	38.1
21	138 33.4	39.0
22	153 33.6	40.0
23	168 33.7	40.9
24	183 33.8	− 8 41.8
code	—	− 10

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.0
5	Achernar	335 59.2	−57 28.1
30	Acrux	174 00.4	−62 50.6
19	Adhara	255 47.7	−28 54.2
10	Aldebaran	291 40.6	+16 25.2
32	Alioth	167 00.3	+56 12.5
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.6	− 1 13.6
25	Alphard	218 40.2	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.2	−42 33.3
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.4
43	Atria	109 03.9	−68 57.0
22	Avior	234 36.6	−59 21.3
13	Bellatrix	279 19.9	+ 6 18.8
16	Betelg'se	271 49.6	+ 7 24.2
17	Canopus	264 15.9	−52 39.8
12	Capella	281 40.4	+45 57.2
53	Deneb	50 02.0	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.8	+61 59.9
14	Elnath	279 09.0	+28 34.3
47	Eltanin	91 07.1	+51 29.8
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.6	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.2
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.7	+74 20.7
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.7
24	Miapl'dus	221 50.0	−69 31.3
9	Mirfak	309 44.2	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.4	−56 53.3
21	Pollux	244 22.4	+28 08.4
20	Procyon	245 46.5	+ 5 20.8
46	R'ahague	96 48.2	+12 35.6
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 54.9	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.1	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.7	−43 14.4
49	Vega	81 09.4	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 13	14	15
h	m s	m s	m s
0	+13 33.5	+13 47.9	+14 01.7
6	+13 37.1	+13 51.4	+14 05.1
12	+13 40.7	+13 54.8	+14 08.4
18	+13 44.3	+13 58.3	+14 11.7
24	+13 47.9	+14 01.7	+14 15.0

Lat.	Sunrise	Twlt. begins	Moonrise 13	14	15	16
N °	h m	h m	h m	h m	h m	h m
72	7 18	3 22	▬	▬	▬	▬
70	7 08	3 36	▬	▬	▬	17 34
68	6 59	3 47	▬	▬	▬	16 42
66	6 52	3 57	▬	▬	16 39	16 09
64	6 46	4 04	▬	16 03	15 52	15 45
62	6 41	4 10	14 34	15 08	15 21	15 26
60	6 36	4 15	13 54	14 35	14 57	15 10
58	6 32	4 19	13 26	14 11	14 39	14 57
56	6 29	4 23	13 05	13 51	14 23	14 45
54	6 25	4 26	12 47	13 34	14 09	14 35
52	6 23	4 29	12 32	13 20	13 58	14 26
50	6 20	4 31	12 19	13 08	13 47	14 17
45	6 14	4 36	11 52	12 42	13 25	14 00
40	6 09	4 38	11 31	12 22	13 07	13 45
35	6 05	4 40	11 13	12 05	12 52	13 33
30	6 01	4 40	10 58	11 50	12 39	13 22
20	5 54	4 41	10 32	11 25	12 16	13 04
10	5 48	4 38	10 10	11 04	11 57	12 48
0	5 43	4 34	9 49	10 44	11 39	12 33
10	5 37	4 26	9 28	10 24	11 20	12 17
20	5 31	4 17	9 06	10 02	11 01	12 01
30	5 23	4 03	8 40	9 37	10 38	11 42
35	5 19	3 53	8 25	9 22	10 25	11 31
40	5 14	3 41	8 08	9 08	10 09	11 18
45	5 09	3 26	7 47	8 44	9 51	11 04
50	5 02	3 05	7 20	8 18	9 28	10 45
52	4 59	2 54	7 07	8 06	9 17	10 36
54	4 55	2 43	6 53	7 51	9 04	10 26
56	4 51	2 28	6 35	7 35	8 50	10 15
58	4 47	2 11	6 14	7 14	8 33	10 02
60	4 42	1 48	5 48	6 49	8 12	9 47
S						

Lat.	Sunset	Twlt. ends	Moonset 13	14	15	16
N °	h m	h m	h m	h m	h m	h m
72	16 12	20 03	▬	▬	▬	▬
70	16 23	19 50	▬	▬	▬	20 15
68	16 32	19 39	▬	▬	▬	21 06
66	16 39	19 31	▬	▬	19 15	21 37
64	16 45	19 24	▬	17 56	20 02	22 01
62	16 50	19 18	17 31	18 52	20 32	22 19
60	16 55	19 14	18 11	19 24	20 55	22 34
58	16 59	19 10	18 38	19 48	21 13	22 47
56	17 03	19 07	19 00	20 08	21 29	22 58
54	17 06	19 04	19 18	20 24	21 42	23 07
52	17 09	19 01	19 33	20 38	21 53	23 16
50	17 12	18 59	19 46	20 50	22 04	23 23
45	17 18	18 55	20 13	21 15	22 25	23 39
40	17 23	18 53	20 34	21 35	22 42	23 53
35	17 27	18 51	20 52	21 51	22 56	24 04
30	17 31	18 51	21 07	22 06	23 08	24 13
20	17 38	18 51	21 32	22 30	23 30	24 30
10	17 44	18 54	21 55	22 51	23 48	24 44
0	17 49	18 58	22 15	23 10	24 05	0 05
10	17 55	19 06	22 36	23 29	24 21	0 21
20	18 02	19 17	22 58	23 50	24 39	0 39
30	18 09	19 31	23 23	24 14	0 14	1 00
35	18 13	19 41	23 38	24 28	0 28	1 12
40	18 18	19 54	23 56	24 44	0 44	1 25
45	18 24	20 10	24 16	0 16	1 03	1 41
50	18 31	20 31	24 43	0 43	1 26	2 01
52	18 34	20 41	0 02	0 55	1 38	2 10
54	18 38	20 54	0 16	1 10	1 51	2 21
56	18 42	21 09	0 33	1 27	2 05	2 32
58	18 46	21 27	0 54	1 47	2 23	2 46
60	18 51	21 51	1 21	2 13	2 44	3 02
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
13	16 02	10 12	9 51	4 19	12 24
14	16 57	10 13	9 50	4 15	12 20
15	17 52	10 13	9 48	4 11	12 17
16	18 45	10 14	9 46	4 07	12 13

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	13	14	15
°	′	′	′
0	14.2	15.0	16.1
4	14.2	15.0	16.1
8	14.2	15.0	16.1
12	14.2	15.1	16.0
16	14.2	15.1	16.0
20	14.2	15.1	16.0
24	14.3	15.1	16.0
28	14.3	15.1	16.0
32	14.3	15.1	16.0
36	14.4	15.1	16.0
40	14.4	15.1	16.0
44	14.5	15.2	15.9
48	14.5	15.2	15.9
52	14.6	15.2	15.9
56	14.7	15.2	15.9
60	14.7	15.3	15.8
64	14.8	15.3	15.8
68	14.9	15.3	15.8
72	14.9	15.3	15.8
76	15.0	15.4	15.7
80	15.1	15.4	15.7
84	15.2	15.4	15.7
88	15.2	15.4	15.7
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	13	14	15
°	′	′	′
0	16.4	15.8	15.3
4	16.3	15.8	15.3
8	16.3	15.8	15.3
12	16.3	15.8	15.3
16	16.3	15.8	15.3
20	16.3	15.8	15.3
24	16.2	15.8	15.3
28	16.2	15.8	15.3
32	16.2	15.8	15.3
36	16.1	15.8	15.3
40	16.1	15.7	15.4
44	16.0	15.7	15.4
48	16.0	15.7	15.4
52	15.9	15.7	15.4
56	15.8	15.7	15.4
60	15.8	15.6	15.5
64	15.7	15.6	15.5
68	15.6	15.6	15.5
72	15.6	15.6	15.5
76	15.5	15.5	15.6
80	15.4	15.5	15.6
84	15.3	15.5	15.6
88	15.3	15.4	15.7
90			

Subtract from table, back cover

GMT	♈	VENUS −3.4		MARS 2.0		JUPITER −2.1		SATURN 0.8		MOON			
	GHA	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
16 0	24 12.9	206 37.3	+ 2 39.5	213 13.9	+ 5 14.9	298 02.3	+22 48.9	176 16.1	− 9 05.5	88 45.7	85	−21 53.8	+ 87
1	39 15.4	221 36.9	38.3	228 14.9	14.2	313 04.7	48.9	191 18.3	05.6	103 13.2	85	21 45.1	+ 88
2	54 17.8	236 36.6	37.2	243 15.9	13.6	328 07.2	48.9	206 20.4	05.7	117 40.7	86	21 36.3	+ 89
3	69 20.3	251 36.2	•• 36.0	258 17.0	•• 13.0	343 09.7	•• 48.9	221 22.6	•• 05.8	132 08.3	85	•21 27.4	+ 91
4	84 22.8	266 35.8	34.8	273 18.0	12.4	358 12.2	48.9	236 24.8	05.9	146 35.8	86	21 18.3	+ 92
5	99 25.2	281 35.4	33.6	288 19.0	11.8	13 14.6	48.9	251 27.0	06.0	161 03.4	87	21 09.1	+ 94
6	114 27.7	296 35.0	+ 2 32.4	303 20.0	+ 5 11.2	28 17.1	+22 48.9	266 29.2	− 9 06.1	175 31.1	86	−20 59.7	+ 94
7	129 30.2	311 34.6	31.2	318 21.0	10.6	43 19.6	48.9	281 31.3	06.2	189 58.7	87	20 50.3	+ 96
8	144 32.6	326 34.2	30.0	333 22.1	10.0	58 22.1	48.9	296 33.5	06.3	204 26.4	88	20 40.7	+ 97
9	159 35.1	341 33.9	•• 28.8	348 23.1	•• 09.3	73 24.5	•• 48.9	311 35.7	•• 06.5	218 54.2	87	•20 31.0	+ 99
10	174 37.5	356 33.5	27.6	3 24.1	08.7	88 27.0	48.9	326 37.9	06.6	233 21.9	88	20 21.1	+100
11	189 40.0	11 33.1	26.4	18 25.1	08.1	103 29.5	48.9	341 40.0	06.7	247 49.7	88	20 11.1	+101
12	204 42.5	26 32.7	+ 2 25.3	33 26.1	+ 5 07.5	118 32.0	+22 48.9	356 42.2	− 9 06.8	262 17.5	89	−20 01.0	+102
13	219 44.9	41 32.3	24.1	48 27.2	06.9	133 34.4	48.9	11 44.4	06.9	276 45.4	89	19 50.8	+104
14	234 47.4	56 31.9	22.9	63 28.2	06.3	148 36.9	48.9	26 46.6	07.0	291 13.3	89	19 40.4	+104
15	249 49.9	71 31.6	•• 21.7	78 29.2	•• 05.7	163 39.4	•• 48.9	41 48.8	•• 07.1	305 41.2	90	•19 30.0	+106
16	264 52.3	86 31.2	20.5	93 30.2	05.1	178 41.9	48.9	56 50.9	07.2	320 09.2	89	19 19.4	+107
17	279 54.8	101 30.8	19.3	108 31.2	04.4	193 44.4	48.9	71 53.1	07.3	334 37.1	91	19 08.7	+109
18	294 57.3	116 30.4	+ 2 18.1	123 32.3	+ 5 03.8	208 46.8	+22 48.9	86 55.3	− 9 07.4	349 05.2	90	−18 57.8	+109
19	309 59.7	131 30.0	16.9	138 33.3	03.2	223 49.3	48.9	101 57.5	07.5	3 33.2	91	18 46.9	+111
20	325 02.2	146 29.6	15.7	153 34.3	02.6	238 51.8	48.9	116 59.7	07.6	18 01.3	91	18 35.8	+112
21	340 04.7	161 29.3	•• 14.5	168 35.3	•• 02.0	253 54.3	•• 48.9	132 01.8	•• 07.7	32 29.4	91	•18 24.6	+113
22	355 07.1	176 28.9	13.3	183 36.4	01.4	268 56.8	48.9	147 04.0	07.8	46 57.5	92	18 13.3	+114
23	10 09.6	191 28.5	12.1	198 37.4	00.8	283 59.2	48.9	162 06.2	08.0	61 25.7	92	18 01.9	+116
17 0	25 12.0	206 28.1	+ 2 10.9	213 38.4	+ 5 00.1	299 01.7	+22 48.9	177 08.4	− 9 08.1	75 53.9	93	−17 50.3	+116
1	40 14.5	221 27.7	09.8	228 39.4	4 59.5	314 04.2	48.9	192 10.6	08.2	90 22.2	92	17 38.7	+118
2	55 17.0	236 27.3	08.6	243 40.4	58.9	329 06.7	48.9	207 12.7	08.3	104 50.4	93	17 26.9	+119
3	70 19.4	251 26.9	•• 07.4	258 41.5	•• 58.3	344 09.2	•• 48.9	222 14.9	•• 08.4	119 18.7	94	•17 15.0	+120
4	85 21.9	266 26.6	06.2	273 42.5	57.7	359 11.6	48.9	237 17.1	08.5	133 47.1	93	17 03.0	+121
5	100 24.4	281 26.2	05.0	288 43.5	57.1	14 14.1	48.9	252 19.3	08.6	148 15.4	94	16 50.9	+122
6	115 26.8	296 25.8	+ 2 03.8	303 44.5	+ 4 56.5	29 16.6	+22 48.9	267 21.4	− 9 08.7	162 43.8	95	−16 38.7	+123
7	130 29.3	311 25.4	02.6	318 45.6	55.9	44 19.1	48.9	282 23.6	08.8	177 12.3	94	16 26.4	+124
8	145 31.8	326 25.0	01.4	333 46.6	55.2	59 21.6	48.9	297 25.8	08.9	191 40.7	95	16 14.0	+126
9	160 34.2	341 24.6	• 2 00.2	348 47.6	•• 54.6	74 24.1	•• 48.9	312 28.0	•• 09.0	206 09.2	95	•16 01.4	+126
10	175 36.7	356 24.3	1 59.0	3 48.6	54.0	89 26.5	48.9	327 30.2	09.1	220 37.7	96	15 48.8	+127
11	190 39.1	11 23.9	57.8	18 49.6	53.4	104 29.0	48.9	342 32.3	09.2	235 06.3	95	15 36.1	+129
12	205 41.6	26 23.5	+ 1 56.6	33 50.7	+ 4 52.8	119 31.5	+22 48.9	357 34.5	− 9 09.3	249 34.8	96	−15 23.2	+129
13	220 44.1	41 23.1	55.4	48 51.7	52.2	134 34.0	48.9	12 36.7	09.5	264 03.4	97	15 10.3	+130
14	235 46.5	56 22.7	54.2	63 52.7	51.6	149 36.5	48.9	27 38.9	09.6	278 32.1	96	14 57.3	+132
15	250 49.0	71 22.3	•• 53.0	78 53.7	•• 51.0	164 39.0	•• 48.9	42 41.0	•• 09.7	293 00.7	97	•14 44.1	+132
16	265 51.5	86 22.0	51.8	93 54.8	50.3	179 41.5	48.9	57 43.2	09.8	307 29.4	97	14 30.9	+133
17	280 53.9	101 21.6	50.6	108 55.8	49.7	194 43.9	48.9	72 45.4	09.9	321 58.1	97	14 17.6	+135
18	295 56.4	116 21.2	+ 1 49.4	123 56.8	+ 4 49.1	209 46.4	+22 48.9	87 47.6	− 9 10.0	336 26.8	98	−14 04.1	+135
19	310 58.9	131 20.8	48.2	138 57.8	48.5	224 48.9	48.9	102 49.8	10.1	350 55.6	98	13 50.6	+136
20	326 01.3	146 20.4	47.0	153 58.8	47.9	239 51.4	48.9	117 51.9	10.2	5 24.4	98	13 37.0	+137
21	341 03.8	161 20.0	•• 45.8	168 59.9	•• 47.3	254 53.9	•• 48.9	132 54.1	•• 10.3	19 53.2	98	•13 23.3	+138
22	356 06.3	176 19.7	44.7	184 00.9	46.7	269 56.4	48.9	147 56.3	10.4	34 22.0	99	13 09.5	+139
23	11 08.7	191 19.3	43.5	199 01.9	46.0	284 58.9	48.9	162 58.5	10.5	48 50.9	98	12 55.6	+140
18 0	26 11.2	206 18.9	+ 1 42.3	214 02.9	+ 4 45.4	300 01.4	+22 48.9	178 00.7	− 9 10.6	63 19.7	99	−12 41.6	+140
1	41 13.6	221 18.5	41.1	229 04.0	44.8	315 03.9	48.9	193 02.8	10.7	77 48.6	100	12 27.6	+142
2	56 16.1	236 18.1	39.9	244 05.0	44.2	330 06.4	48.9	208 05.0	10.8	92 17.6	99	12 13.4	+142
3	71 18.6	251 17.7	•• 38.7	259 06.0	•• 43.6	345 08.8	•• 48.9	223 07.2	•• 10.9	106 46.5	99	•11 59.2	+143
4	86 21.0	266 17.3	37.5	274 07.0	43.0	0 11.3	48.9	238 09.4	11.1	121 15.4	100	11 44.9	+144
5	101 23.5	281 17.0	36.3	289 08.1	42.4	15 13.8	48.9	253 11.5	11.2	135 44.4	100	11 30.5	+145
6	116 26.0	296 16.6	+ 1 35.1	304 09.1	+ 4 41.7	30 16.3	+22 48.9	268 13.7	− 9 11.3	150 13.4	100	−11 16.0	+146
7	131 28.4	311 16.2	33.9	319 10.1	41.1	45 18.8	48.9	283 15.9	11.4	164 42.4	101	11 01.4	+146
8	146 30.9	326 15.8	32.7	334 11.1	40.5	60 21.3	48.9	298 18.1	11.5	179 11.5	100	10 46.8	+147
9	161 33.4	341 15.4	•• 31.5	349 12.1	•• 39.9	75 23.8	•• 48.9	313 20.3	•• 11.6	193 40.5	101	•10 32.1	+148
10	176 35.8	356 15.0	30.3	4 13.2	39.3	90 26.3	48.9	328 22.4	11.7	208 09.6	100	10 17.3	+149
11	191 38.3	11 14.7	29.1	19 14.2	38.7	105 28.8	48.9	343 24.6	11.8	222 38.6	101	10 02.4	+149
12	206 40.7	26 14.3	+ 1 27.9	34 15.2	+ 4 38.1	120 31.3	+22 48.9	358 26.8	− 9 11.9	237 07.7	101	− 9 47.5	+150
13	221 43.2	41 13.9	26.7	49 16.2	37.4	135 33.8	48.9	13 29.0	12.0	251 36.8	101	9 32.5	+151
14	236 45.7	56 13.5	25.5	64 17.3	36.8	150 36.3	48.9	28 31.1	12.1	266 05.9	101	9 17.4	+151
15	251 48.1	71 13.1	•• 24.3	79 18.3	•• 36.2	165 38.8	•• 48.9	43 33.3	•• 12.2	280 35.0	102	• 9 02.3	+152
16	266 50.6	86 12.7	23.1	94 19.3	35.6	180 41.3	48.9	58 35.5	12.3	295 04.2	101	8 47.1	+153
17	281 53.1	101 12.4	21.9	109 20.3	35.0	195 43.8	48.9	73 37.7	12.4	309 33.3	102	8 31.8	+153
18	296 55.5	116 12.0	+ 1 20.7	124 21.4	+ 4 34.4	210 46.3	+22 48.9	88 39.9	− 9 12.5	324 02.5	101	− 8 16.5	+154
19	311 58.0	131 11.6	19.5	139 22.4	33.8	225 48.8	48.9	103 42.0	12.7	338 31.6	102	8 01.1	+155
20	327 00.5	146 11.2	18.3	154 23.4	33.1	240 51.3	48.9	118 44.2	12.8	353 00.8	101	7 45.6	+155
21	342 02.9	161 10.8	•• 17.1	169 24.4	•• 32.5	255 53.8	•• 48.9	133 46.4	•• 12.9	7 29.9	102	• 7 30.1	+156
22	357 05.4	176 10.4	15.9	184 25.5	31.9	270 56.2	48.9	148 48.6	13.0	21 59.1	102	7 14.5	+156
23	12 07.9	191 10.1	14.7	199 26.5	31.3	285 58.7	48.9	163 50.7	13.1	36 28.3	102	6 58.9	+157
24	27 10.3	206 09.7	+ 1 13.5	214 27.5	+ 4 30.7	301 01.2	+22 48.9	178 52.9	− 9 13.2	50 57.5	101	− 6 43.2	+157
code	—	− 4	− 12	+ 10	− 6	+ 25	0	+ 22	− 2				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
16 0	183 33.8	− 8 41.8
1	198 34.0	42.7
2	213 34.1	43.7
3	228 34.2	44.6
4	243 34.4	45.5
5	258 34.5	46.4
6	273 34.6	− 8 47.4
7	288 34.8	48.3
8	303 34.9	49.2
9	318 35.0	50.1
10	333 35.2	51.0
11	348 35.3	52.0
12	3 35.4	− 8 52.9
13	18 35.6	53.8
14	33 35.7	54.7
15	48 35.8	55.6
16	63 36.0	56.6
17	78 36.1	57.5
18	93 36.2	− 8 58.4
19	108 36.4	8 59.3
20	123 36.5	9 00.2
21	138 36.6	01.2
22	153 36.8	02.1
23	168 36.9	03.0
17 0	183 37.0	− 9 03.9
1	198 37.1	04.8
2	213 37.3	05.7
3	228 37.4	06.7
4	243 37.5	07.6
5	258 37.7	08.5
6	273 37.8	− 9 09.4
7	288 37.9	10.3
8	303 38.0	11.2
9	318 38.2	12.2
10	333 38.3	13.1
11	348 38.4	14.0
12	3 38.6	− 9 14.9
13	18 38.7	15.8
14	33 38.8	16.7
15	48 38.9	17.7
16	63 39.1	18.6
17	78 39.2	19.5
18	93 39.3	− 9 20.4
19	108 39.4	21.3
20	123 39.6	22.2
21	138 39.7	23.1
22	153 39.8	24.0
23	168 39.9	25.0
18 0	183 40.1	− 9 25.9
1	198 40.2	26.8
2	213 40.3	27.7
3	228 40.4	28.6
4	243 40.6	29.5
5	258 40.7	30.4
6	273 40.8	− 9 31.3
7	288 40.9	32.3
8	303 41.0	33.2
9	318 41.2	34.1
10	333 41.3	35.0
11	348 41.4	35.9
12	3 41.5	− 9 36.8
13	18 41.7	37.7
14	33 41.8	38.6
15	48 41.9	39.5
16	63 42.0	40.4
17	78 42.1	41.3
18	93 42.3	− 9 42.3
19	108 42.4	43.2
20	123 42.5	44.1
21	138 42.6	45.0
22	153 42.7	45.9
23	168 42.8	46.8
24	183 43.0	− 9 47.7
code	—	− 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.1
5	Achernar	335 59.2	−57 28.1
30	Acrux	174 00.3	−62 50.5
19	Adhara	255 47.6	−28 54.2
10	Aldebaran	291 40.5	+16 25.3
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.4	−47 11.2
15	Alnilam	276 31.6	− 1 13.6
25	Alphard	218 40.2	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.2	−42 33.3
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.0	−68 57.0
22	Avior	234 36.6	−59 21.3
13	Bellatrix	279 19.8	+ 6 18.8
16	Betelg'se	271 49.6	+ 7 24.2
17	Canopus	264 15.9	−52 39.8
12	Capella	281 40.4	+45 57.2
53	Deneb	50 02.0	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.7	+61 59.9
14	Elnath	279 09.0	+28 34.3
47	Eltanin	91 07.2	+51 29.8
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.6	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.7	+74 20.7
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.6
24	Miapl'dus	221 49.9	−69 31.3
9	Mirfak	309 44.1	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.4	− 56 53.3
21	Pollux	244 22.4	+28 08.4
20	Procyon	245 46.5	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.3	+12 11.7
11	Rigel	281 54.9	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.1	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.7	−43 14.4
49	Vega	81 09.4	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 16	17	18
h	m s	m s	m s
0	+14 15.0	+14 27.8	+14 40.0
6	+14 18.3	+14 30.9	+14 43.0
12	+14 21.5	+14 34.0	+14 45.9
18	+14 24.6	+14 37.0	+14 48.8
24	+14 27.8	+14 40.0	+14 51.6

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 16 h m	17 h m	18 h m	19 h m
72	7 33	3 38	■	17 02	16 15	15 42
70	7 20	3 50	17 34	16 33	16 02	15 38
68	7 10	4 00	16 42	16 11	15 52	15 35
66	7 02	4 07	16 09	15 54	15 43	15 33
64	6 55	4 13	15 45	15 40	15 35	15 31
62	6 49	4 18	15 26	15 28	15 29	15 29
60	6 44	4 22	15 10	15 18	15 23	15 27
58	6 39	4 26	14 57	15 09	15 18	15 26
56	6 35	4 29	14 45	15 01	15 14	15 25
54	6 31	4 31	14 35	14 54	15 09	15 23
52	6 28	4 34	14 26	14 48	15 06	15 22
50	6 25	4 36	14 17	14 42	15 02	15 21
45	6 18	4 39	14 00	14 29	14 55	15 19
40	6 12	4 41	13 45	14 19	14 49	15 17
35	6 07	4 43	13 33	14 10	14 44	15 16
30	6 03	4 42	13 22	14 02	14 39	15 14
20	5 55	4 41	13 04	13 49	14 31	15 12
10	5 49	4 39	12 48	13 37	14 24	15 10
0	5 42	4 32	12 33	13 25	14 17	15 08
10	5 36	4 25	12 17	13 14	14 10	15 06
20	5 28	4 14	12 01	13 02	14 03	15 04
30	5 20	3 58	11 42	12 48	13 54	15 02
35	5 15	3 48	11 31	12 40	13 50	15 00
40	5 10	3 35	11 18	12 31	13 44	14 59
45	5 04	3 18	11 04	12 20	13 38	14 57
50	4 56	2 57	10 45	12 07	13 30	14 55
52	4 52	2 45	10 36	12 00	13 27	14 54
54	4 48	2 32	10 26	11 54	13 23	14 53
56	4 44	2 16	10 15	11 46	13 18	14 52
58	4 39	1 57	10 02	11 37	13 13	14 50
60	4 34	1 30	9 47	11 27	13 08	14 49
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 16 h m	17 h m	18 h m	19 h m
72	15 56	19 46	■	22 40	25 16	1 16
70	16 09	19 35	20 15	23 07	25 26	1 26
68	16 19	19 26	21 06	23 26	25 34	1 34
66	16 28	19 20	21 37	23 42	25 41	1 41
64	16 35	19 14	22 01	23 55	25 46	1 46
62	16 41	19 09	22 19	24 05	0 05	1 51
60	16 46	19 05	22 34	24 14	0 14	1 55
58	16 51	19 02	22 47	24 22	0 22	1 59
56	16 55	18 59	22 58	24 29	0 29	2 02
54	16 59	18 57	23 07	24 35	0 35	2 05
52	17 02	18 54	23 16	24 41	0 41	2 08
50	17 05	18 53	23 23	24 46	0 46	2 10
45	17 12	18 50	23 39	24 57	0 57	2 15
40	17 18	18 48	23 53	25 05	1 05	2 20
35	17 23	18 47	24 04	0 04	1 13	2 23
30	17 28	18 48	24 13	0 13	1 20	2 26
20	17 35	18 49	24 30	0 30	1 31	2 32
10	17 42	18 52	24 44	0 44	1 41	2 37
0	17 49	18 59	0 05	0 58	1 50	2 41
10	17 55	19 06	0 21	1 11	1 59	2 45
20	18 03	19 18	0 39	1 25	2 09	2 50
30	18 11	19 34	1 00	1 41	2 19	2 55
35	18 16	19 45	1 12	1 51	2 26	2 58
40	18 22	19 59	1 25	2 01	2 33	3 01
45	18 28	20 15	1 41	2 13	2 41	3 05
50	18 36	20 38	2 01	2 28	2 50	3 10
52	18 40	20 50	2 10	2 35	2 55	3 12
54	18 44	21 04	2 21	2 43	3 00	3 14
56	18 48	21 20	2 32	2 51	3 05	3 17
58	18 53	21 41	2 46	3 01	3 11	3 19
60	18 59	22 10	3 02	3 12	3 18	3 22
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
16	18 45	10 14	9 46	4 07	12 13
17	19 38	10 14	9 45	4 03	12 10
18	20 29	10 15	9 43	3 59	12 06
19	21 20	10 16	9 42	3 55	12 03

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	16	17	18
°	′	′	′
0	17.1	18.2	19.2
4	17.1	18.2	19.2
8	17.1	18.2	19.2
12	17.0	18.2	19.2
16	17.0	18.1	19.1
20	17.0	18.1	19.0
24	17.0	18.0	18.9
28	16.9	17.9	18.9
32	16.9	17.9	18.7
36	16.8	17.8	18.6
40	16.8	17.7	18.5
44	16.7	17.6	18.4
48	16.6	17.5	18.2
52	16.6	17.4	18.0
56	16.5	17.2	17.9
60	16.4	17.1	17.7
64	16.4	17.0	17.5
68	16.3	16.8	17.3
72	16.2	16.7	17.1
76	16.1	16.6	16.9
80	16.0	16.4	16.7
84	16.0	16.3	16.5
88	15.9	16.2	16.4
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	16	17	18
°	′	′	′
0	14.7	14.0	13.4
4	14.7	14.0	13.5
8	14.7	14.1	13.5
12	14.7	14.1	13.5
16	14.7	14.1	13.6
20	14.8	14.2	13.7
24	14.8	14.2	13.7
28	14.8	14.3	13.8
32	14.9	14.4	13.9
36	14.9	14.5	14.1
40	15.0	14.6	14.2
44	15.0	14.7	14.3
48	15.1	14.8	14.5
52	15.2	14.9	14.6
56	15.2	15.0	14.8
60	15.3	15.1	15.0
64	15.4	15.3	15.2
68	15.5	15.4	15.3
72	15.5	15.5	15.5
76	15.6	15.7	15.7
80	15.7	15.8	15.9
84	15.8	16.0	16.1
88	15.9	16.1	16.3
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
19 0	27 10.3	206 09.7	+ 1 13.5	214 27.5	+ 4 30.7	301 01.2	+22 48.9	178 52.9	− 9 13.2	50 57.5	101	− 6 43.2	+157
1	42 12.8	221 09.3	12.3	229 28.5	30.1	316 03.7	48.9	193 55.1	13.3	65 26.6	102	6 27.5	+158
2	57 15.2	236 08.9	11.1	244 29.6	29.5	331 06.2	48.9	208 57.3	13.4	79 55.8	102	6 11.7	+159
3	72 17.7	251 08.5	•• 09.9	259 30.6	•• 28.8	346 08.7	•• 48.9	223 59.5	•• 13.5	94 25.0	102	• 5 55.8	+159
4	87 20.2	266 08.1	08.7	274 31.6	28.2	1 11.2	48.9	239 01.6	13.6	108 54.2	101	5 39.9	+159
5	102 22.6	281 07.8	07.5	289 32.6	27.6	16 13.7	48.9	254 03.8	13.7	123 23.3	102	5 24.0	+160
6	117 25.1	296 07.4	+ 1 06.3	304 33.7	+ 4 27.0	31 16.3	+22 48.9	269 06.0	− 9 13.8	137 52.5	102	− 5 08.0	+160
7	132 27.6	311 07.0	05.1	319 34.7	26.4	46 18.8	48.9	284 08.2	13.9	152 21.7	101	4 52.0	+161
8	147 30.0	326 06.6	03.9	334 35.7	25.8	61 21.3	48.9	299 10.3	14.0	166 50.8	102	4 35.9	+161
9	162 32.5	341 06.2	•• 02.7	349 36.7	•• 25.2	76 23.8	•• 48.9	314 12.5	•• 14.2	181 20.0	101	• 4 19.8	+161
10	177 35.0	356 05.8	01.5	4 37.8	24.5	91 26.3	48.9	329 14.7	14.3	195 49.1	102	4 03.7	+162
11	192 37.4	11 05.5	1 00.3	19 38.8	23.9	106 28.8	48.9	344 16.9	14.4	210 18.3	101	3 47.5	+163
12	207 39.9	26 05.1	+ 0 59.1	34 39.8	+ 4 23.3	121 31.3	+22 48.9	359 19.1	− 9 14.5	224 47.4	101	− 3 31.2	+162
13	222 42.3	41 04.7	57.9	49 40.8	22.7	136 33.8	48.9	14 21.2	14.6	239 16.5	101	3 15.0	+163
14	237 44.8	56 04.3	56.7	64 41.9	22.1	151 36.3	48.9	29 23.4	14.7	253 45.6	101	2 58.7	+163
15	252 47.3	71 03.9	•• 55.5	79 42.9	•• 21.5	166 38.8	•• 48.9	44 25.6	•• 14.8	268 14.7	101	• 2 42.4	+164
16	267 49.7	86 03.5	54.3	94 43.9	20.9	181 41.3	48.9	59 27.8	14.9	282 43.8	101	2 26.0	+163
17	282 52.2	101 03.2	53.1	109 44.9	20.2	196 43.8	48.9	74 29.9	15.0	297 12.9	100	2 09.7	+164
18	297 54.7	116 02.8	+ 0 51.9	124 46.0	+ 4 19.6	211 46.3	+22 48.9	89 32.1	− 9 15.1	311 41.9	101	− 1 53.3	+165
19	312 57.1	131 02.4	50.6	139 47.0	19.0	226 48.8	48.9	104 34.3	15.2	326 11.0	100	1 36.8	+164
20	327 59.6	146 02.0	49.4	154 48.0	18.4	241 51.3	48.9	119 36.5	15.3	340 40.0	100	1 20.4	+165
21	343 02.1	161 01.6	•• 48.2	169 49.0	•• 17.8	256 53.8	•• 48.9	134 38.7	•• 15.4	355 09.0	100	• 1 03.9	+165
22	358 04.5	176 01.2	47.0	184 50.1	17.2	271 56.3	48.9	149 40.8	15.5	9 38.0	99	0 47.4	+165
23	13 07.0	191 00.9	45.8	199 51.1	16.5	286 58.8	48.9	164 43.0	15.6	24 06.9	100	0 30.9	+165
20 0	28 09.5	206 00.5	+ 0 44.6	214 52.1	+ 4 15.9	302 01.3	+22 48.9	179 45.2	− 9 15.7	38 35.9	99	− 0 14.4	+165
1	43 11.9	221 00.1	43.4	229 53.1	15.3	317 03.8	48.9	194 47.4	15.9	53 04.8	99	+ 0 02.1	+166
2	58 14.4	235 59.7	42.2	244 54.2	14.7	332 06.4	48.9	209 49.5	16.0	67 33.7	98	0 18.7	+165
3	73 16.8	250 59.3	•• 41.0	259 55.2	•• 14.1	347 08.9	•• 48.9	224 51.7	•• 16.1	82 02.5	98	• 0 35.2	+166
4	88 19.3	265 58.9	39.8	274 56.2	13.5	2 11.4	48.9	239 53.9	16.2	96 31.3	99	0 51.8	+165
5	103 21.8	280 58.5	38.6	289 57.2	12.9	17 13.9	48.9	254 56.1	16.3	111 00.2	97	1 08.3	+166
6	118 24.2	295 58.2	+ 0 37.4	304 58.3	+ 4 12.2	32 16.4	+22 48.9	269 58.2	− 9 16.4	125 28.9	98	+ 1 24.9	+166
7	133 26.7	310 57.8	36.2	319 59.3	11.6	47 18.9	48.9	285 00.4	16.5	139 57.7	97	1 41.5	+165
8	148 29.2	325 57.4	35.0	335 00.3	11.0	62 21.4	48.9	300 02.6	16.6	154 26.4	97	1 58.0	+166
9	163 31.6	340 57.0	•• 33.8	350 01.4	•• 10.4	77 23.9	•• 48.9	315 04.8	•• 16.7	168 55.1	96	• 2 14.6	+166
10	178 34.1	355 56.6	32.6	5 02.4	09.8	92 26.4	48.9	330 07.0	16.8	183 23.7	97	2 31.2	+165
11	193 36.6	10 56.2	31.4	20 03.4	09.2	107 29.0	48.9	345 09.1	16.9	197 52.4	95	2 47.7	+166
12	208 39.0	25 55.9	+ 0 30.2	35 04.4	+ 4 08.5	122 31.5	+22 48.9	0 11.3	− 9 17.0	212 20.9	96	+ 3 04.3	+165
13	223 41.5	40 55.5	29.0	50 05.5	07.9	137 34.0	48.9	15 13.5	17.1	226 49.5	95	3 20.8	+166
14	238 44.0	55 55.1	27.8	65 06.5	07.3	152 36.5	48.9	30 15.7	17.2	241 18.0	95	3 37.4	+165
15	253 46.4	70 54.7	•• 26.6	80 07.5	•• 06.7	167 39.0	•• 48.9	45 17.8	•• 17.3	255 46.5	94	• 3 53.9	+165
16	268 48.9	85 54.3	25.4	95 08.5	06.1	182 41.5	48.9	60 20.0	17.5	270 14.9	94	4 10.4	+165
17	283 51.3	100 53.9	24.2	110 09.6	05.5	197 44.0	48.9	75 22.2	17.6	284 43.3	94	4 26.9	+164
18	298 53.8	115 53.6	+ 0 23.0	125 10.6	+ 4 04.9	212 46.6	+22 48.9	90 24.4	− 9 17.7	299 11.7	93	+ 4 43.3	+165
19	313 56.3	130 53.2	21.7	140 11.6	04.2	227 49.1	48.9	105 26.6	17.8	313 40.0	92	4 59.8	+164
20	328 58.7	145 52.8	20.5	155 12.6	03.6	242 51.6	48.9	120 28.7	17.9	328 08.2	93	5 16.2	+164
21	344 01.2	160 52.4	•• 19.3	170 13.7	•• 03.0	257 54.1	•• 48.9	135 30.9	•• 18.0	342 36.5	91	• 5 32.6	+164
22	359 03.7	175 52.0	18.1	185 14.7	02.4	272 56.6	48.9	150 33.1	18.1	357 04.6	92	5 49.0	+163
23	14 06.1	190 51.6	16.9	200 15.7	01.8	287 59.1	48.9	165 35.3	18.2	11 32.8	91	6 05.3	+163
21 0	29 08.6	205 51.2	+ 0 15.7	215 16.8	+ 4 01.2	303 01.7	+22 48.9	180 37.4	− 9 18.3	26 00.9	90	+ 6 21.6	+163
1	44 11.1	220 50.9	14.5	230 17.8	4 00.5	318 04.2	48.9	195 39.6	18.4	40 28.9	90	6 37.9	+163
2	59 13.5	235 50.5	13.3	245 18.8	3 59.9	333 06.7	48.9	210 41.8	18.5	54 56.9	89	6 54.2	+162
3	74 16.0	250 50.1	•• 12.1	260 19.8	•• 59.3	348 09.2	•• 48.9	225 44.0	•• 18.6	69 24.8	89	• 7 10.4	+161
4	89 18.4	265 49.7	10.9	275 20.9	58.7	3 11.7	48.9	240 46.1	18.7	83 52.7	88	7 26.5	+162
5	104 20.9	280 49.3	09.7	290 21.9	58.1	18 14.2	48.9	255 48.3	18.8	98 20.5	88	7 42.7	+160
6	119 23.4	295 48.9	+ 0 08.5	305 22.9	+ 3 57.5	33 16.8	+22 48.9	270 50.5	− 9 18.9	112 48.3	88	+ 7 58.7	+161
7	134 25.8	310 48.5	07.3	320 23.9	56.9	48 19.3	48.9	285 52.7	19.0	127 16.1	86	8 14.8	+160
8	149 28.3	325 48.2	06.1	335 25.0	56.2	63 21.8	48.9	300 54.9	19.2	141 43.7	87	8 30.8	+159
9	164 30.8	340 47.8	•• 04.9	350 26.0	•• 55.6	78 24.3	•• 48.9	315 57.0	•• 19.3	156 11.4	85	• 8 46.7	+159
10	179 33.2	355 47.4	03.7	5 27.0	55.0	93 26.8	48.9	330 59.2	19.4	170 38.9	85	9 02.6	+158
11	194 35.7	10 47.0	02.4	20 28.1	54.4	108 29.4	48.9	346 01.4	19.5	185 06.4	85	9 18.4	+158
12	209 38.2	25 46.6	+ 0 01.2	35 29.1	+ 3 53.8	123 31.9	+22 48.9	1 03.6	− 9 19.6	199 33.9	84	+ 9 34.2	+157
13	224 40.6	40 46.2	0 00.0	50 30.1	53.2	138 34.4	48.9	16 05.7	19.7	214 01.3	83	9 49.9	+157
14	239 43.1	55 45.9	− 0 01.2	65 31.1	52.5	153 36.9	48.9	31 07.9	19.8	228 28.6	83	10 05.6	+156
15	254 45.6	70 45.5	•• 02.4	80 32.2	•• 51.9	168 39.5	•• 48.9	46 10.1	•• 19.9	242 55.9	82	•10 21.2	+156
16	269 48.0	85 45.1	03.6	95 33.2	51.3	183 42.0	48.9	61 12.3	20.0	257 23.1	82	10 36.8	+154
17	284 50.5	100 44.7	04.8	110 34.2	50.7	198 44.5	48.9	76 14.4	20.1	271 50.3	81	10 52.2	+154
18	299 52.9	115 44.3	− 0 06.0	125 35.3	+ 3 50.1	213 47.0	+22 48.9	91 16.6	− 9 20.2	286 17.4	80	+11 07.6	+154
19	314 55.4	130 43.9	07.2	140 36.3	49.5	228 49.6	48.9	106 18.8	20.3	300 44.4	80	11 23.0	+152
20	329 57.9	145 43.5	08.4	155 37.3	48.8	243 52.1	48.9	121 21.0	20.4	315 11.4	79	11 38.2	+152
21	345 00.3	160 43.2	•• 09.6	170 38.3	•• 48.2	258 54.6	•• 48.9	136 23.2	•• 20.5	329 38.3	79	•11 53.4	+151
22	0 02.8	175 42.8	10.8	185 39.4	47.6	273 57.1	48.9	151 25.3	20.6	344 05.2	78	12 08.5	+151
23	15 05.3	190 42.4	12.0	200 40.4	47.0	288 59.7	48.9	166 27.5	20.7	358 32.0	77	12 23.6	+149
24	30 07.7	205 42.0	− 0 13.3	215 41.4	+ 3 46.4	304 02.2	+22 48.9	181 29.7	− 9 20.9	12 58.7	76	+12 38.5	+149
code	−	− 4	− 12	+ 11	− 6	+ 25	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
19 h 0	183 43.0	− 9 47.7
1	198 43.1	48.6
2	213 43.2	49.5
3	228 43.3	50.4
4	243 43.4	51.3
5	258 43.5	52.2
6	273 43.7	− 9 53.1
7	288 43.8	54.0
8	303 43.9	54.9
9	318 44.0	55.8
10	333 44.1	56.7
11	348 44.2	57.6
12	3 44.4	− 9 58.6
13	18 44.5	9 59.5
14	33 44.6	10 00.4
15	48 44.7	01.3
16	63 44.8	02.2
17	78 44.9	03.1
18	93 45.0	−10 04.0
19	108 45.2	04.9
20	123 45.3	05.8
21	138 45.4	06.7
22	153 45.5	07.6
23	168 45.6	08.5
20 0	183 45.7	−10 09.4
1	198 45.8	10.3
2	213 45.9	11.2
3	228 46.0	12.1
4	243 46.2	13.0
5	258 46.3	13.9
6	273 46.4	−10 14.8
7	288 46.5	15.7
8	303 46.6	16.6
9	318 46.7	17.5
10	333 46.8	18.4
11	348 46.9	19.3
12	3 47.0	−10 20.2
13	18 47.1	21.1
14	33 47.2	22.0
15	48 47.4	22.8
16	63 47.5	23.7
17	78 47.6	24.6
18	93 47.7	−10 25.5
19	108 47.8	26.4
20	123 47.9	27.3
21	138 48.0	28.2
22	153 48.1	29.1
23	168 48.2	30.0
21 0	183 48.3	−10 30.9
1	198 48.4	31.8
2	213 48.5	32.7
3	228 48.6	33.6
4	243 48.7	34.5
5	258 48.8	35.4
6	273 48.9	−10 36.3
7	288 49.0	37.2
8	303 49.1	38.0
9	318 49.2	38.9
10	333 49.3	39.8
11	348 49.4	40.7
12	3 49.5	−10 41.6
13	18 49.6	42.5
14	33 49.8	43.4
15	48 49.9	44.3
16	63 50.0	45.2
17	78 50.1	46.1
18	93 50.2	−10 46.9
19	108 50.3	47.8
20	123 50.4	48.7
21	138 50.5	49.6
22	153 50.6	50.5
23	168 50.6	51.4
24	183 50.7	−10 52.3
code	—	- 9

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.8	−40 29.1
5	Achernar	335 59.2	−57 28.1
30	Acrux	174 00.3	−62 50.5
19	Adhara	255 47.6	−28 54.2
10	Aldebaran	291 40.5	+16 25.3
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.4	+49 32.6
55	Al Na'ir	28 39.5	−47 11.2
15	Alnilam	276 31.6	− 1 13.6
25	Alphard	218 40.2	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.2	−42 33.3
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.0	−68 57.0
22	Avior	234 36.6	−59 21.3
13	Bellatrix	279 19.8	+ 6 18.8
16	Betelg'se	271 49.6	+ 7 24.2
17	Canopus	264 15.8	−52 39.8
12	Capella	281 40.3	+45 57.2
53	Deneb	50 02.0	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.7	+61 59.8
14	Elnath	279 09.0	+28 34.3
47	Eltanin	91 07.2	+51 29.8
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.6	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.7	+74 20.6
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.6	+ 3 54.8
36	Menkent	149 00.9	−36 08.6
24	Miapl'dus	221 49.9	−69 31.3
9	Mirfak	309 44.1	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.5	−56 53.3
21	Pollux	244 22.3	+28 08.4
20	Procyon	245 46.5	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.2	+12 11.6
11	Rigel	281 54.8	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 22.9	−37 04.5
18	Sirius	259 13.0	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.6	−43 14.4
49	Vega	81 09.4	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 19	20	21
h	m s	m s	m s
0	+14 51.6	+15 02.6	+15 13.0
6	+14 54.4	+15 05.3	+15 15.5
12	+14 57.2	+15 07.9	+15 18.0
18	+14 59.9	+15 10.5	+15 20.4
24	+15 02.6	+15 13.0	+15 22.8

Lat.	Sunrise	Twlt. begins	Moonrise 19	20	21	22
N°	h m	h m	h m	h m	h m	h m
72	7 48	3 52	15 42	15 11	14 35	13 39
70	7 34	4 02	15 38	15 16	14 50	14 15
68	7 22	4 10	15 35	15 20	15 03	14 41
66	7 12	4 17	15 33	15 23	15 13	15 02
64	7 04	4 22	15 31	15 26	15 22	15 18
62	6 57	4 26	15 29	15 29	15 30	15 31
60	6 51	4 30	15 27	15 31	15 36	15 43
58	6 46	4 33	15 26	15 34	15 42	15 53
56	6 41	4 35	15 25	15 35	15 47	16 02
54	6 37	4 37	15 23	15 37	15 52	16 10
52	6 33	4 39	15 22	15 39	15 56	16 17
50	6 30	4 40	15 21	15 40	16 00	16 24
45	6 22	4 43	15 19	15 43	16 09	16 38
40	6 15	4 44	15 17	15 46	16 16	16 49
35	6 10	4 45	15 16	15 48	16 22	16 59
30	6 05	4 44	15 14	15 50	16 27	17 08
20	5 56	4 42	15 12	15 54	16 37	17 23
10	5 49	4 38	15 10	15 57	16 45	17 37
0	5 42	4 32	15 08	16 00	16 53	17 49
10	5 34	4 24	15 06	16 03	17 01	18 02
20	5 26	4 11	15 04	16 06	17 10	18 16
30	5 17	3 55	15 02	16 10	17 20	18 32
35	5 12	3 44	15 00	16 12	17 26	18 41
40	5 06	3 30	14 59	16 15	17 32	18 51
45	4 58	3 12	14 57	16 18	17 40	19 04
50	4 50	2 48	14 55	16 21	17 50	19 19
52	4 46	2 36	14 54	16 23	17 54	19 27
54	4 41	2 22	14 53	16 25	17 59	19 35
56	4 37	2 04	14 52	16 27	18 04	19 44
58	4 31	1 41	14 50	16 29	18 11	19 54
60	4 25	1 08	14 49	16 32	18 17	20 06
S						

Lat.	Sunset	Twlt. ends	Moonset 19	20	21	22
N°	h m	h m	h m	h m	h m	h m
72	15 40	19 31	1 16	3 41	6 09	9 03
70	15 55	19 22	1 26	3 40	5 57	8 28
68	16 06	19 14	1 34	3 39	5 47	8 04
66	16 16	19 08	1 41	3 38	5 39	7 46
64	16 24	19 03	1 46	3 38	5 32	7 31
62	16 31	18 59	1 51	3 37	5 26	7 18
60	16 38	18 57	1 55	3 37	5 21	7 08
58	16 43	18 54	1 59	3 37	5 16	6 59
56	16 48	18 52	2 02	3 36	5 12	6 51
54	16 52	18 50	2 05	3 36	5 09	6 44
52	16 56	18 49	2 08	3 36	5 06	6 38
50	16 59	18 47	2 10	3 36	5 03	6 32
45	17 07	18 45	2 15	3 35	4 57	6 20
40	17 14	18 44	2 20	3 35	4 51	6 10
35	17 19	18 43	2 23	3 34	4 47	6 01
30	17 24	18 44	2 26	3 34	4 43	5 54
20	17 33	18 47	2 32	3 33	4 36	5 41
10	17 41	18 52	2 37	3 33	4 30	5 30
0	17 48	18 58	2 41	3 32	4 25	5 19
10	17 56	19 07	2 45	3 32	4 19	5 09
20	18 04	19 20	2 50	3 31	4 13	4 58
30	18 13	19 37	2 55	3 30	4 07	4 45
35	18 19	19 49	2 58	3 30	4 03	4 38
40	18 25	20 03	3 01	3 30	3 58	4 30
45	18 32	20 21	3 05	3 29	3 53	4 20
50	18 41	20 45	3 10	3 28	3 47	4 09
52	18 45	20 58	3 12	3 28	3 45	4 04
54	18 49	21 13	3 14	3 28	3 42	3 58
56	18 54	21 31	3 17	3 27	3 38	3 51
58	19 00	21 56	3 19	3 27	3 35	3 44
60	19 06	22 31	3 22	3 26	3 31	3 36
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
19	21 20	10 16	9 42	3 55	12 03
20	22 12	10 16	9 40	3 51	11 59
21	23 06	10 17	9 38	3 47	11 56
22	24 03	10 18	9 37	3 43	11 52

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	19	20	21
°	′	′	′
0	20.0	20.6	20.9
4	20.0	20.6	20.9
8	20.0	20.6	20.8
12	19.9	20.5	20.8
16	19.8	20.4	20.7
20	19.8	20.4	20.6
24	19.6	20.2	20.5
28	19.5	20.1	20.3
32	19.4	20.0	20.2
36	19.3	19.8	20.0
40	19.1	19.6	19.8
44	18.9	19.4	19.6
48	18.8	19.2	19.4
52	18.6	19.0	19.2
56	18.4	18.8	18.9
60	18.1	18.5	18.7
64	17.9	18.3	18.4
68	17.7	18.0	18.1
72	17.5	17.7	17.9
76	17.2	17.5	17.6
80	17.0	17.2	17.3
84	16.7	16.9	17.0
88	16.6	16.7	16.8
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	19	20	21
°	′	′	′
0	13.0	12.6	12.5
4	13.0	12.7	12.5
8	13.1	12.7	12.6
12	13.1	12.8	12.6
16	13.2	12.8	12.7
20	13.3	12.9	12.8
24	13.4	13.0	12.9
28	13.5	13.2	13.1
32	13.6	13.3	13.2
36	13.7	13.5	13.4
40	13.9	13.7	13.6
44	14.1	13.9	13.8
48	14.3	14.1	14.0
52	14.4	14.3	14.2
56	14.6	14.5	14.5
60	14.9	14.8	14.7
64	15.1	15.0	15.0
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.0	16.1	16.1
84	16.3	16.4	16.4
88	16.4	16.6	16.6
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
22 0	30 07.7	205 42.0	− 0 13.3	215 41.4	+ 3 46.4	304 02.2	+22 48.9	181 29.7	− 9 20.9	12 58.7	76	+12 38.5	+149
1	45 10.2	220 41.6	14.5	230 42.5	45.8	319 04.7	48.9	196 31.9	21.0	27 25.3	76	12 53.4	+148
2	60 12.7	235 41.2	15.7	245 43.5	45.1	334 07.2	48.9	211 34.0	21.1	41 51.9	75	13 08.2	+147
3	75 15.1	250 40.8	16.9	260 44.5	44.5	349 09.8	48.9	226 36.2	21.2	56 18.4	75	13 22.9	+146
4	90 17.6	265 40.5	18.1	275 45.5	43.9	4 12.3	48.9	241 38.4	21.3	70 44.9	74	13 37.5	+146
5	105 20.1	280 40.1	19.3	290 46.6	43.3	19 14.8	48.9	256 40.6	21.4	85 11.3	73	13 52.1	+144
6	120 22.5	295 39.7	− 0 20.5	305 47.6	+ 3 42.7	34 17.3	+22 48.9	271 42.7	− 9 21.5	99 37.6	73	+14 06.5	+143
7	135 25.0	310 39.3	21.7	320 48.6	42.1	49 19.9	48.9	286 44.9	21.6	114 03.9	72	14 20.8	+143
8	150 27.4	325 38.9	22.9	335 49.7	41.4	64 22.4	48.9	301 47.1	21.7	128 30.1	71	14 35.1	+141
9	165 29.9	340 38.5	24.1	350 50.7	40.8	79 24.9	48.9	316 49.3	21.8	142 56.2	70	14 49.2	+141
10	180 32.4	355 38.1	25.3	5 51.7	40.2	94 27.5	48.9	331 51.5	21.9	157 22.2	70	15 03.3	+139
11	195 34.8	10 37.8	26.5	20 52.7	39.6	109 30.0	48.9	346 53.6	22.0	171 48.2	69	15 17.2	+139
12	210 37.3	25 37.4	− 0 27.8	35 53.8	+ 3 39.0	124 32.5	+22 48.9	1 55.8	− 9 22.1	186 14.1	69	+15 31.1	+137
13	225 39.8	40 37.0	29.0	50 54.8	38.4	139 35.1	48.9	16 58.0	22.2	200 40.0	68	15 44.8	+136
14	240 42.2	55 36.6	30.2	65 55.8	37.7	154 37.6	48.9	32 00.2	22.3	215 05.8	67	15 58.4	+135
15	255 44.7	70 36.2	31.4	80 56.9	37.1	169 40.1	48.9	47 02.3	22.4	229 31.5	66	16 11.9	+135
16	270 47.2	85 35.8	32.6	95 57.9	36.5	184 42.7	48.9	62 04.5	22.6	243 57.1	66	16 25.4	+132
17	285 49.6	100 35.4	33.8	110 58.9	35.9	199 45.2	48.9	77 06.7	22.7	258 22.7	65	16 38.6	+132
18	300 52.1	115 35.0	− 0 35.0	125 59.9	+ 3 35.3	214 47.7	+22 48.9	92 08.9	− 9 22.8	272 48.2	65	+16 51.8	+131
19	315 54.5	130 34.7	36.2	141 01.0	34.7	229 50.2	48.9	107 11.0	22.9	287 13.7	63	17 04.9	+129
20	330 57.0	145 34.3	37.4	156 02.0	34.1	244 52.8	48.9	122 13.2	23.0	301 39.0	63	17 17.8	+128
21	345 59.5	160 33.9	38.6	171 03.0	33.4	259 55.3	48.9	137 15.4	23.1	316 04.3	63	17 30.6	+127
22	1 01.9	175 33.5	39.8	186 04.1	32.8	274 57.9	48.9	152 17.6	23.2	330 29.6	62	17 43.3	+126
23	16 04.4	190 33.1	41.1	201 05.1	32.2	290 00.4	48.9	167 19.8	23.3	344 54.8	61	17 55.9	+125
23 0	31 06.9	205 32.7	− 0 42.3	216 06.1	+ 3 31.6	305 02.9	+22 48.9	182 21.9	− 9 23.4	359 19.9	60	+18 08.4	+123
1	46 09.3	220 32.3	43.5	231 07.2	31.0	320 05.5	48.9	197 24.1	23.5	13 44.9	60	18 20.7	+122
2	61 11.8	235 31.9	44.7	246 08.2	30.4	335 08.0	48.9	212 26.3	23.6	28 09.9	59	18 32.9	+120
3	76 14.3	250 31.6	45.9	261 09.2	29.7	350 10.5	48.9	227 28.5	23.7	42 34.8	59	18 44.9	+119
4	91 16.7	265 31.2	47.1	276 10.2	29.1	5 13.1	48.9	242 30.6	23.8	56 59.7	57	18 56.8	+118
5	106 19.2	280 30.8	48.3	291 11.3	28.5	20 15.6	48.9	257 32.8	23.9	71 24.4	58	19 08.6	+117
6	121 21.7	295 30.4	− 0 49.5	306 12.3	+ 3 27.9	35 18.1	+22 48.9	272 35.0	− 9 24.0	85 49.2	56	+19 20.3	+115
7	136 24.1	310 30.0	50.7	321 13.3	27.3	50 20.7	48.9	287 37.2	24.1	100 13.8	56	19 31.8	+114
8	151 26.6	325 29.6	51.9	336 14.4	26.7	65 23.2	48.9	302 39.3	24.2	114 38.4	55	19 43.2	+112
9	166 29.0	340 29.2	53.2	351 15.4	26.0	80 25.8	48.9	317 41.5	24.4	129 02.9	55	19 54.4	+111
10	181 31.5	355 28.8	54.4	6 16.4	25.4	95 28.3	48.9	332 43.7	24.5	143 27.4	54	20 05.5	+109
11	196 34.0	10 28.5	55.6	21 17.5	24.8	110 30.8	48.9	347 45.9	24.6	157 51.8	54	20 16.4	+108
12	211 36.4	25 28.1	− 0 56.8	36 18.5	+ 3 24.2	125 33.4	+22 48.9	2 48.1	− 9 24.7	172 16.2	53	+20 27.2	+107
13	226 38.9	40 27.7	58.0	51 19.5	23.6	140 35.9	48.9	17 50.2	24.8	186 40.5	52	20 37.9	+105
14	241 41.4	55 27.3	0 59.2	66 20.5	22.9	155 38.5	48.9	32 52.4	24.9	201 04.7	52	20 48.4	+103
15	256 43.8	70 26.9	1 00.4	81 21.6	22.3	170 41.0	48.9	47 54.6	25.0	215 28.9	51	20 58.7	+102
16	271 46.3	85 26.5	01.6	96 22.6	21.7	185 43.5	48.9	62 56.8	25.1	229 53.0	51	21 08.9	+101
17	286 48.8	100 26.1	02.8	111 23.6	21.1	200 46.1	48.9	77 58.9	25.2	244 17.1	50	21 19.0	+ 99
18	301 51.2	115 25.7	− 1 04.0	126 24.7	+ 3 20.5	215 48.6	+22 48.9	93 01.1	− 9 25.3	258 41.1	50	+21 28.9	+ 97
19	316 53.7	130 25.4	05.3	141 25.7	19.9	230 51.2	48.9	108 03.3	25.4	273 05.1	49	21 38.6	+ 96
20	331 56.2	145 25.0	06.5	156 26.7	19.2	245 53.7	48.9	123 05.5	25.5	287 29.0	49	21 48.2	+ 94
21	346 58.6	160 24.6	07.7	171 27.8	18.6	260 56.3	48.9	138 07.6	25.6	301 52.9	48	+21 57.6	+ 92
22	2 01.1	175 24.2	08.9	186 28.8	18.0	275 58.8	48.8	153 09.8	25.7	316 16.7	48	22 06.8	+ 91
23	17 03.5	190 23.8	10.1	201 29.8	17.4	291 01.3	48.8	168 12.0	25.8	330 40.5	48	22 15.9	+ 90
24 0	32 06.0	205 23.4	− 1 11.3	216 30.9	+ 3 16.8	306 03.9	+22 48.8	183 14.2	− 9 25.9	345 04.3	46	+22 24.9	+ 87
1	47 08.5	220 23.0	12.5	231 31.9	16.2	321 06.4	48.8	198 16.3	26.0	359 27.9	47	22 33.6	+ 86
2	62 10.9	235 22.6	13.7	246 32.9	15.5	336 09.0	48.8	213 18.5	26.2	13 51.6	46	22 42.2	+ 85
3	77 13.4	250 22.2	14.9	261 33.9	14.9	351 11.5	48.8	228 20.7	26.3	28 15.2	46	+22 50.7	+ 83
4	92 15.9	265 21.9	16.1	276 35.0	14.3	6 14.1	48.8	243 22.9	26.4	42 38.8	45	22 59.0	+ 81
5	107 18.3	280 21.5	17.4	291 36.0	13.7	21 16.6	48.8	258 25.1	26.5	57 02.3	45	23 07.1	+ 79
6	122 20.8	295 21.1	− 1 18.6	306 37.0	+ 3 13.1	36 19.2	+22 48.8	273 27.2	− 9 26.6	71 25.8	44	+23 15.0	+ 78
7	137 23.3	310 20.7	19.8	321 38.1	12.5	51 21.7	48.8	288 29.4	26.7	85 49.2	45	23 22.8	+ 76
8	152 25.7	325 20.3	21.0	336 39.1	11.8	66 24.3	48.8	303 31.6	26.8	100 12.7	44	23 30.4	+ 74
9	167 28.2	340 19.9	22.2	351 40.1	11.2	81 26.8	48.8	318 33.8	26.9	114 36.1	43	23 37.8	+ 73
10	182 30.6	355 19.5	23.4	6 41.2	10.6	96 29.3	48.8	333 35.9	27.0	128 59.4	44	23 45.1	+ 70
11	197 33.1	10 19.1	24.6	21 42.2	10.0	111 31.9	48.8	348 38.1	27.1	143 22.8	43	23 52.1	+ 70
12	212 35.6	25 18.7	− 1 25.8	36 43.2	+ 3 09.4	126 34.4	+22 48.8	3 40.3	− 9 27.2	157 46.1	43	+23 59.1	+ 67
13	227 38.0	40 18.3	27.0	51 44.3	08.8	141 37.0	48.8	18 42.5	27.3	172 09.4	43	24 05.8	+ 66
14	242 40.5	55 18.0	28.2	66 45.3	08.1	156 39.5	48.8	33 44.6	27.4	186 32.7	42	24 12.4	+ 63
15	257 43.0	70 17.6	29.5	81 46.3	07.5	171 42.1	48.8	48 46.8	27.5	200 55.9	42	+24 18.7	+ 63
16	272 45.4	85 17.2	30.7	96 47.4	06.9	186 44.6	48.8	63 49.0	27.6	215 19.1	42	24 25.0	+ 60
17	287 47.9	100 16.8	31.9	111 48.4	06.3	201 47.2	48.8	78 51.2	27.7	229 42.3	42	24 31.0	+ 58
18	302 50.4	115 16.4	− 1 33.1	126 49.4	+ 3 05.7	216 49.7	+22 48.8	93 53.4	− 9 27.8	244 05.5	42	+24 36.8	+ 57
19	317 52.8	130 16.0	34.3	141 50.4	05.1	231 52.3	48.8	108 55.5	27.9	258 28.7	42	24 42.5	+ 55
20	332 55.3	145 15.6	35.5	156 51.5	04.4	246 54.9	48.8	123 57.7	28.1	272 51.9	42	24 48.0	+ 54
21	347 57.8	160 15.2	36.7	171 52.5	03.8	261 57.4	48.8	138 59.9	28.2	287 15.1	41	+24 53.4	+ 51
22	3 00.2	175 14.8	37.9	186 53.5	03.2	277 00.0	48.8	154 02.1	28.3	301 38.2	42	24 58.5	+ 50
23	18 02.7	190 14.4	39.1	201 54.6	02.6	292 02.5	48.8	169 04.2	28.4	316 01.4	42	25 03.5	+ 48
24	33 05.1	205 14.0	− 1 40.4	216 55.6	+ 3 02.0	307 05.1	+22 48.8	184 06.4	− 9 28.5	330 24.6	41	+25 08.3	+ 46
code	−	− 4	− 12	+ 10	− 6	+ 25	0	+ 21	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
22 0	183 50.7	−10 52.3
1	198 50.8	53.2
2	213 50.9	54.1
3	228 51.0	54.9
4	243 51.1	55.8
5	258 51.2	56.7
6	273 51.3	−10 57.6
7	288 51.4	58.5
8	303 51.5	10 59.4
9	318 51.6	11 00.3
10	333 51.7	01.1
11	348 51.8	02.0
12	3 51.9	−11 02.9
13	18 52.0	03.8
14	33 52.1	04.7
15	48 52.2	05.6
16	63 52.3	06.4
17	78 52.4	07.3
18	93 52.5	−11 08.2
19	108 52.6	09.1
20	123 52.6	10.0
21	138 52.7	10.8
22	153 52.8	11.7
23	168 52.9	12.6
23 0	183 53.0	−11 13.5
1	198 53.1	14.4
2	213 53.2	15.3
3	228 53.3	16.1
4	243 53.4	17.0
5	258 53.5	17.9
6	273 53.6	−11 18.8
7	288 53.6	19.6
8	303 53.7	20.5
9	318 53.8	21.4
10	333 53.9	22.3
11	348 54.0	23.2
12	3 54.1	−11 24.0
13	18 54.2	24.9
14	33 54.3	25.8
15	48 54.3	26.7
16	63 54.4	27.5
17	78 54.5	28.4
18	93 54.6	−11 29.3
19	108 54.7	30.2
20	123 54.8	31.0
21	138 54.9	31.9
22	153 54.9	32.8
23	168 55.0	33.7
24 0	183 55.1	−11 34.5
1	198 55.2	35.4
2	213 55.3	36.3
3	228 55.4	37.2
4	243 55.4	38.0
5	258 55.5	38.9
6	273 55.6	−11 39.8
7	288 55.7	40.6
8	303 55.8	41.5
9	318 55.9	42.4
10	333 55.9	43.3
11	348 56.0	44.1
12	3 56.1	−11 45.0
13	18 56.2	45.9
14	33 56.3	46.7
15	48 56.3	47.6
16	63 56.4	48.5
17	78 56.5	49.3
18	93 56.6	−11 50.2
19	108 56.7	51.1
20	123 56.7	51.9
21	138 56.8	52.8
22	153 56.9	53.7
23	168 57.0	54.5
24	183 57.0	−11 55.4
code	—	− 9

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.1
5	Achernar	335 59.2	−57 28.1
30	Acrux	174 00.3	−62 50.5
19	Adhara	255 47.6	−28 54.2
10	Aldebaran	291 40.5	+16 25.3
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.4	+49 32.5
55	Al Na'ir	28 39.5	−47 11.2
15	Alnilam	276 31.6	− 1 13.6
25	Alphard	218 40.2	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.2	−42 33.3
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.0	−68 57.0
22	Avior	234 36.5	−59 21.3
13	Bellatrix	279 19.8	+ 6 18.8
16	Betelg'se	271 49.6	+ 7 24.2
17	Canopus	264 15.8	−52 39.8
12	Capella	281 40.3	+45 57.2
53	Deneb	50 02.0	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.7	+61 59.8
14	Elnath	279 09.0	+28 34.3
47	Eltanin	91 07.2	+51 29.8
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 12.9	−29 52.0
31	Gacrux	172 51.6	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.7	+74 20.6
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.9	−36 08.6
24	Miapl'dus	221 49.8	−69 31.3
9	Mirfak	309 44.1	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.5	−56 53.3
21	Pollux	244 22.3	+28 08.4
20	Procyon	245 46.5	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.2	+12 11.6
11	Rigel	281 54.8	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 23.0	−37 04.5
18	Sirius	259 13.0	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.6	−43 14.4
49	Vega	81 09.4	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

Lat.	Sunrise	Twlt. begins	Moonrise 22	23	24	25
N °	h m	h m	h m	h m	h m	h m
72	8 04	4 06	13 39	▭	▭	▭
70	7 47	4 14	14 15	▭	▭	▭
68	7 33	4 20	14 41	14 01	▭	▭
66	7 22	4 26	15 02	14 44	▭	▭
64	7 13	4 30	15 18	15 13	15 09	15 03
62	7 05	4 34	15 31	15 36	15 47	16 15
60	6 59	4 36	15 43	15 54	16 14	16 51
58	6 53	4 39	15 53	16 09	16 35	17 17
56	6 47	4 41	16 02	16 23	16 53	17 37
54	6 43	4 43	16 10	16 34	17 07	17 55
52	6 38	4 44	16 17	16 44	17 20	18 09
50	6 34	4 45	16 24	16 53	17 32	18 22
45	6 26	4 47	16 38	17 12	17 56	18 48
40	6 19	4 48	16 49	17 28	18 15	19 09
35	6 13	4 47	16 59	17 42	18 31	19 27
30	6 07	4 46	17 08	17 53	18 45	19 42
20	5 58	4 43	17 23	18 14	19 09	20 07
10	5 49	4 38	17 37	18 31	19 29	20 29
0	5 41	4 31	17 49	18 48	19 49	20 50
10	5 33	4 21	18 02	19 05	20 08	21 11
20	5 24	4 09	18 16	19 23	20 29	21 33
30	5 14	3 51	18 32	19 44	20 54	21 59
35	5 08	3 39	18 41	19 56	21 08	22 14
40	5 01	3 24	18 51	20 10	21 25	22 32
45	4 53	3 05	19 04	20 27	21 45	22 53
50	4 44	2 39	19 19	20 48	22 10	23 20
52	4 39	2 25	19 27	20 58	22 22	23 33
54	4 34	2 09	19 35	21 09	22 36	23 48
56	4 29	1 49	19 44	21 22	22 53	24 06
58	4 23	1 22	19 54	21 38	23 12	24 27
60	4 16	0 38	20 06	21 56	23 37	24 55
S						

Lat.	Sunset	Twlt. ends	Moonset 22	23	24	25
N °	h m	h m	h m	h m	h m	h m
72	15 24	19 17	9 03	▭	▭	▭
70	15 41	19 10	8 28	▭	▭	▭
68	15 54	19 03	8 04	10 47	▭	▭
66	16 05	18 58	7 46	10 05	▭	▭
64	16 14	18 54	7 31	9 36	11 48	14 02
62	16 22	18 51	7 18	9 15	11 10	12 50
60	16 29	18 49	7 08	8 57	10 43	12 14
58	16 35	18 47	6 59	8 43	10 23	11 49
56	16 40	18 45	6 51	8 30	10 06	11 28
54	16 45	18 43	6 44	8 20	9 51	11 11
52	16 50	18 43	6 38	8 10	9 39	10 57
50	16 54	18 42	6 32	8 02	9 27	10 44
45	17 02	18 40	6 20	7 44	9 04	10 18
40	17 10	18 41	6 10	7 29	8 46	9 57
35	17 16	18 41	6 01	7 17	8 31	9 40
30	17 21	18 41	5 54	7 06	8 17	9 25
20	17 31	18 45	5 41	6 47	7 55	9 00
10	17 40	18 51	5 30	6 32	7 35	8 38
0	17 48	18 58	5 19	6 17	7 17	8 18
10	17 56	19 08	5 09	6 02	6 58	7 58
20	18 05	19 21	4 58	5 46	6 39	7 36
30	18 15	19 39	4 45	5 28	6 17	7 11
35	18 22	19 52	4 38	5 18	6 03	6 56
40	18 28	20 07	4 30	5 06	5 48	6 39
45	18 36	20 26	4 20	4 52	5 30	6 18
50	18 46	20 53	4 09	4 35	5 08	5 53
52	18 51	21 08	4 04	4 27	4 58	5 40
54	18 56	21 25	3 58	4 18	4 46	5 26
56	19 01	21 45	3 51	4 08	4 33	5 09
58	19 08	22 15	3 44	3 57	4 17	4 49
60	19 15	23 09	3 36	3 44	3 58	4 25
S						

GMT	Equation of Time (App.—Mean) 22	23	24
h	m s	m s	m s
0	+15 22.8	+15 31.9	+15 40.3
6	+15 25.1	+15 34.0	+15 42.3
12	+15 27.4	+15 36.2	+15 44.2
18	+15 29.7	+15 38.2	+15 46.1
24	+15 31.9	+15 40.3	+15 48.0

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
22	24 03	10 18	9 37	3 43	11 52
23	0 03	10 18	9 35	3 39	11 49
24	1 02	10 19	9 33	3 35	11 45
25	2 03	10 19	9 32	3 31	11 42

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	22	23	24
°	′	′	′
0	20.8	20.3	19.4
4	20.7	20.2	19.4
8	20.7	20.2	19.3
12	20.6	20.1	19.3
16	20.6	20.1	19.2
20	20.5	20.0	19.2
24	20.4	19.9	19.1
28	20.2	19.8	19.0
32	20.1	19.6	18.9
36	19.9	19.5	18.7
40	19.7	19.3	18.6
44	19.5	19.1	18.5
48	19.3	18.9	18.3
52	19.1	18.7	18.1
56	18.8	18.5	18.0
60	18.6	18.3	17.8
64	18.3	18.1	17.6
68	18.1	17.8	17.4
72	17.8	17.6	17.2
76	17.5	17.3	17.0
80	17.2	17.1	16.8
84	17.0	16.8	16.6
88	16.7	16.6	16.4
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	22	23	24
°	′	′	′
0	12.6	12.9	13.4
4	12.6	12.9	13.4
8	12.6	12.9	13.4
12	12.7	13.0	13.5
16	12.8	13.0	13.5
20	12.9	13.1	13.6
24	13.0	13.2	13.7
28	13.1	13.4	13.8
32	13.3	13.5	13.9
36	13.4	13.6	14.0
40	13.6	13.8	14.1
44	13.8	14.0	14.3
48	14.0	14.2	14.4
52	14.3	14.4	14.6
56	14.5	14.6	14.8
60	14.7	14.8	15.0
64	15.0	15.1	15.1
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.7
80	16.1	16.0	15.9
84	16.4	16.3	16.2
88	16.6	16.5	16.3
90			

Subtract from table, back cover

Full Moon 22

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.1 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
25 0	33 05.1	205 14.0	− 1 40.4	216 55.6	+ 3 02.0	307 05.1	+22 48.8	184 06.4	− 9 28.5	330 24.6	41	+25 08.3	+ 46
1	48 07.6	220 13.7	41.6	231 56.6	01.3	322 07.6	48.8	199 08.6	28.6	344 47.7	42	25 12.9	+ 44
2	63 10.1	235 13.3	42.8	246 57.7	00.7	337 10.2	48.8	214 10.8	28.7	359 10.9	41	25 17.3	+ 42
3	78 12.5	250 12.9	44.0	261 58.7	3 00.1	352 12.7	48.8	229 12.9	28.8	13 34.0	42	25 21.5	+ 41
4	93 15.0	265 12.5	45.2	276 59.7	2 59.5	7 15.3	48.8	244 15.1	28.9	27 57.2	42	25 25.6	+ 39
5	108 17.5	280 12.1	46.4	292 00.8	58.9	22 17.8	48.8	259 17.3	29.0	42 20.4	42	25 29.5	+ 37
6	123 19.9	295 11.7	− 1 47.6	307 01.8	+ 2 58.3	37 20.4	+22 48.8	274 19.5	− 9 29.1	56 43.6	42	+25 33.2	+ 36
7	138 22.4	310 11.3	48.8	322 02.8	57.6	52 22.9	48.8	289 21.6	29.2	71 06.8	42	25 36.8	+ 33
8	153 24.9	325 10.9	50.0	337 03.9	57.0	67 25.5	48.8	304 23.8	29.3	85 30.0	42	25 40.1	+ 32
9	168 27.3	340 10.5	51.3	352 04.9	56.4	82 28.1	48.8	319 26.0	29.4	99 53.2	43	25 43.3	+ 30
10	183 29.8	355 10.1	52.5	7 05.9	55.8	97 30.6	48.8	334 28.2	29.5	114 16.5	43	25 46.3	+ 28
11	198 32.3	10 09.7	53.7	22 07.0	55.2	112 33.2	48.8	349 30.4	29.6	128 39.8	43	25 49.1	+ 26
12	213 34.7	25 09.3	− 1 54.9	37 08.0	+ 2 54.6	127 35.7	+22 48.8	4 32.5	− 9 29.7	143 03.1	43	+25 51.7	+ 25
13	228 37.2	40 08.9	56.1	52 09.0	53.9	142 38.3	48.8	19 34.7	29.8	157 26.4	44	25 54.2	+ 22
14	243 39.6	55 08.6	57.3	67 10.1	53.3	157 40.9	48.8	34 36.9	29.9	171 49.8	43	25 56.4	+ 21
15	258 42.1	70 08.2	58.5	82 11.1	52.7	172 43.4	48.8	49 39.1	30.1	186 13.1	45	25 58.5	+ 20
16	273 44.6	85 07.8	1 59.7	97 12.1	52.1	187 46.0	48.8	64 41.2	30.2	200 36.6	44	26 00.5	+ 17
17	288 47.0	100 07.4	2 00.9	112 13.2	51.5	202 48.5	48.8	79 43.4	30.3	215 00.0	45	26 02.2	+ 16
18	303 49.5	115 07.0	− 2 02.2	127 14.2	+ 2 50.8	217 51.1	+22 48.8	94 45.6	− 9 30.4	229 23.5	45	+26 03.8	+ 14
19	318 52.0	130 06.6	03.4	142 15.2	50.2	232 53.6	48.8	109 47.8	30.5	243 47.0	46	26 05.2	+ 12
20	333 54.4	145 06.2	04.6	157 16.3	49.6	247 56.2	48.8	124 49.9	30.6	258 10.6	46	26 06.4	+ 10
21	348 56.9	160 05.8	05.8	172 17.3	49.0	262 58.8	48.8	139 52.1	30.7	272 34.2	47	26 07.4	+ 9
22	3 59.4	175 05.4	07.0	187 18.3	48.4	278 01.3	48.8	154 54.3	30.8	286 57.9	47	26 08.3	+ 7
23	19 01.8	190 05.0	08.2	202 19.4	47.8	293 03.9	48.8	169 56.5	30.9	301 21.6	47	26 09.0	+ 5
26 0	34 04.3	205 04.6	− 2 09.4	217 20.4	+ 2 47.1	308 06.5	+22 48.8	184 58.7	− 9 31.0	315 45.3	48	+26 09.5	+ 3
1	49 06.8	220 04.2	10.6	232 21.4	46.5	323 09.0	48.8	200 00.8	31.1	330 09.1	49	26 09.8	+ 2
2	64 09.2	235 03.8	11.8	247 22.5	45.9	338 11.6	48.8	215 03.0	31.2	344 33.0	49	26 10.0	0
3	79 11.7	250 03.4	13.1	262 23.5	45.3	353 14.1	48.8	230 05.2	31.3	358 56.9	50	26 10.0	− 2
4	94 14.1	265 03.0	14.3	277 24.5	44.7	8 16.7	48.8	245 07.4	31.4	13 20.9	50	26 09.8	− 3
5	109 16.6	280 02.6	15.5	292 25.6	44.1	23 19.3	48.8	260 09.5	31.5	27 44.9	51	26 09.5	− 6
6	124 19.1	295 02.2	− 2 16.7	307 26.6	+ 2 43.4	38 21.8	+22 48.8	275 11.7	− 9 31.6	42 09.0	51	+26 08.9	− 6
7	139 21.5	310 01.9	17.9	322 27.6	42.8	53 24.4	48.8	290 13.9	31.7	56 33.1	52	26 08.3	− 9
8	154 24.0	325 01.5	19.1	337 28.7	42.2	68 27.0	48.8	305 16.1	31.8	70 57.3	53	26 07.4	− 10
9	169 26.5	340 01.1	20.3	352 29.7	41.6	83 29.5	48.8	320 18.2	32.0	85 21.6	54	26 06.4	− 12
10	184 28.9	355 00.7	21.5	7 30.7	41.0	98 32.1	48.8	335 20.4	32.1	99 46.0	54	26 05.2	− 13
11	199 31.4	10 00.3	22.7	22 31.8	40.3	113 34.7	48.8	350 22.6	32.2	114 10.4	55	26 03.9	− 16
12	214 33.9	24 59.9	− 2 23.9	37 32.8	+ 2 39.7	128 37.2	+22 48.8	5 24.8	− 9 32.3	128 34.9	55	+26 02.3	− 16
13	229 36.3	39 59.5	25.2	52 33.8	39.1	143 39.8	48.8	20 26.9	32.4	142 59.4	57	26 00.7	− 19
14	244 38.8	54 59.1	26.4	67 34.9	38.5	158 42.4	48.8	35 29.1	32.5	157 24.1	57	25 58.8	− 20
15	259 41.3	69 58.7	27.6	82 35.9	37.9	173 44.9	48.8	50 31.3	32.6	171 48.8	58	25 56.8	− 21
16	274 43.7	84 58.3	28.8	97 36.9	37.3	188 47.5	48.8	65 33.5	32.7	186 13.6	58	25 54.7	− 23
17	289 46.2	99 57.9	30.0	112 38.0	36.6	203 50.1	48.8	80 35.7	32.8	200 38.4	60	25 52.4	− 25
18	304 48.6	114 57.5	− 2 31.2	127 39.0	+ 2 36.0	218 52.6	+22 48.8	95 37.8	− 9 32.9	215 03.4	60	+25 49.9	− 27
19	319 51.1	129 57.1	32.4	142 40.0	35.4	233 55.2	48.8	110 40.0	33.0	229 28.4	61	25 47.2	− 27
20	334 53.6	144 56.7	33.6	157 41.1	34.8	248 57.8	48.8	125 42.2	33.1	243 53.5	62	25 44.5	− 30
21	349 56.0	159 56.3	34.8	172 42.1	34.2	264 00.4	48.8	140 44.4	33.2	258 18.7	63	25 41.5	− 31
22	4 58.5	174 55.9	36.1	187 43.1	33.5	279 02.9	48.8	155 46.5	33.3	272 44.0	64	25 38.4	− 32
23	20 01.0	189 55.5	37.3	202 44.2	32.9	294 05.5	48.8	170 48.7	33.4	287 09.4	64	25 35.2	− 34
27 0	35 03.4	204 55.1	− 2 38.5	217 45.2	+ 2 32.3	309 08.1	+22 48.8	185 50.9	− 9 33.5	301 34.8	66	+25 31.8	− 36
1	50 05.9	219 54.7	39.7	232 46.2	31.7	324 10.6	48.7	200 53.1	33.6	316 00.4	66	25 28.2	− 37
2	65 08.4	234 54.3	40.9	247 47.3	31.1	339 13.2	48.7	215 55.2	33.7	330 26.0	67	25 24.5	− 38
3	80 10.8	249 53.9	42.1	262 48.3	30.5	354 15.8	48.7	230 57.4	33.8	344 51.7	69	25 20.7	− 40
4	95 13.3	264 53.5	43.3	277 49.3	29.8	9 18.4	48.7	245 59.6	33.9	359 17.6	69	25 16.7	− 42
5	110 15.7	279 53.1	44.5	292 50.4	29.2	24 20.9	48.7	261 01.8	34.1	13 43.5	70	25 12.5	− 42
6	125 18.2	294 52.7	− 2 45.7	307 51.4	+ 2 28.6	39 23.5	+22 48.7	276 03.9	− 9 34.2	28 09.5	71	+25 08.3	− 45
7	140 20.7	309 52.3	46.9	322 52.4	28.0	54 26.1	48.7	291 06.1	34.3	42 35.6	72	25 03.8	− 45
8	155 23.1	324 51.9	48.2	337 53.5	27.4	69 28.7	48.7	306 08.3	34.4	57 01.8	73	24 59.3	− 47
9	170 25.6	339 51.5	49.4	352 54.5	26.7	84 31.2	48.7	321 10.5	34.5	71 28.1	74	24 54.6	− 49
10	185 28.1	354 51.1	50.6	7 55.5	26.1	99 33.8	48.7	336 12.7	34.6	85 54.5	75	24 49.7	− 49
11	200 30.5	9 50.7	51.8	22 56.6	25.5	114 36.4	48.7	351 14.8	34.7	100 21.0	76	24 44.8	− 51
12	215 33.0	24 50.3	− 2 53.0	37 57.6	+ 2 24.9	129 39.0	+22 48.7	6 17.0	− 9 34.8	114 47.6	77	+24 39.7	− 53
13	230 35.5	39 49.9	54.2	52 58.6	24.3	144 41.5	48.7	21 19.2	34.9	129 14.3	78	24 34.4	− 54
14	245 37.9	54 49.5	55.4	67 59.7	23.7	159 44.1	48.7	36 21.4	35.0	143 41.1	79	24 29.0	− 55
15	260 40.4	69 49.1	56.6	83 00.7	23.0	174 46.7	48.7	51 23.5	35.1	158 08.0	80	24 23.5	− 56
16	275 42.9	84 48.7	57.8	98 01.7	22.4	189 49.3	48.7	66 25.7	35.2	172 35.0	81	24 17.9	− 58
17	290 45.3	99 48.3	2 59.0	113 02.8	21.8	204 51.8	48.7	81 27.9	35.3	187 02.1	82	24 12.1	− 59
18	305 47.8	114 47.9	− 3 00.3	128 03.8	+ 2 21.2	219 54.4	+22 48.7	96 30.1	− 9 35.4	201 29.3	83	+24 06.2	− 60
19	320 50.2	129 47.5	01.5	143 04.8	20.6	234 57.0	48.7	111 32.2	35.5	215 56.6	84	24 00.2	− 62
20	335 52.7	144 47.1	02.7	158 05.9	19.9	249 59.6	48.7	126 34.4	35.6	230 24.0	85	23 54.0	− 63
21	350 55.2	159 46.7	03.9	173 06.9	19.3	265 02.2	48.7	141 36.6	35.7	244 51.5	87	+23 47.7	− 63
22	5 57.6	174 46.3	05.1	188 07.9	18.7	280 04.7	48.7	156 38.8	35.8	259 19.2	87	23 41.4	− 66
23	21 00.1	189 45.9	06.3	203 09.0	18.1	295 07.3	48.7	171 40.9	35.9	273 46.9	88	23 34.8	− 66
24	36 02.6	204 45.5	− 3 07.5	218 10.0	+ 2 17.5	310 09.9	+22 48.7	186 43.1	− 9 36.0	288 14.7	90	+23 28.2	− 68
code	—	− 4	− 13	+ 10	− 6	+ 26	0	+ 21	− 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
25	0	183 57.0	−11 55.4
	1	198 57.1	56.3
	2	213 57.2	57.1
	3	228 57.3	58.0
	4	243 57.3	58.9
	5	258 57.4	11 59.7
	6	273 57.5	−12 00.6
	7	288 57.6	01.5
	8	303 57.6	02.3
	9	318 57.7	03.2
	10	333 57.8	04.1
	11	348 57.9	04.9
	12	3 57.9	−12 05.8
	13	18 58.0	06.6
	14	33 58.1	07.5
	15	48 58.1	08.4
	16	63 58.2	09.2
	17	78 58.3	10.1
	18	93 58.4	−12 10.9
	19	108 58.4	11.8
	20	123 58.5	12.7
	21	138 58.6	13.5
	22	153 58.6	14.4
	23	168 58.7	15.2
26	0	183 58.8	−12 16.1
	1	198 58.8	17.0
	2	213 58.9	17.8
	3	228 59.0	18.7
	4	243 59.0	19.5
	5	258 59.1	20.4
	6	273 59.2	−12 21.2
	7	288 59.3	22.1
	8	303 59.3	23.0
	9	318 59.4	23.8
	10	333 59.4	24.7
	11	348 59.5	25.5
	12	3 59.6	−12 26.4
	13	18 59.6	27.2
	14	33 59.7	28.1
	15	48 59.8	28.9
	16	63 59.8	29.8
	17	78 59.9	30.6
	18	94 00.0	−12 31.5
	19	109 00.0	32.3
	20	124 00.1	33.2
	21	139 00.2	34.0
	22	154 00.2	34.9
	23	169 00.3	35.7
27	0	184 00.3	−12 36.6
	1	199 00.4	37.4
	2	214 00.5	38.3
	3	229 00.5	39.1
	4	244 00.6	40.0
	5	259 00.6	40.8
	6	274 00.7	−12 41.7
	7	289 00.8	42.5
	8	304 00.8	43.4
	9	319 00.9	44.2
	10	334 00.9	45.1
	11	349 01.0	45.9
	12	4 01.0	−12 46.8
	13	19 01.1	47.6
	14	34 01.2	48.5
	15	49 01.2	49.3
	16	64 01.3	50.2
	17	79 01.3	51.0
	18	94 01.4	−12 51.9
	19	109 01.4	52.7
	20	124 01.5	53.5
	21	139 01.5	54.4
	22	154 01.6	55.2
	23	169 01.7	56.1
	24	184 01.7	−12 56.9
code		—	− 8

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.1
5	Achernar	335 59.2	−57 28.1
30	Acrux	174 00.3	−62 50.5
19	Adhara	255 47.6	−28 54.2
10	Aldebaran	291 40.5	+16 25.3
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.4	+49 32.5
55	Al Na'ir	28 39.5	−47 11.2
15	Alnilam	276 31.6	− 1 13.6
25	Alphard	218 40.1	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.3	−42 33.3
42	Antares	113 21.5	−26 20.0
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.0	−68 57.0
22	Avior	234 36.5	−59 21.3
13	Bellatrix	279 19.8	+ 6 18.7
16	Betelg'se	271 49.5	+ 7 24.2
17	Canopus	264 15.8	−52 39.8
12	Capella	281 40.3	+45 57.2
53	Deneb	50 02.0	+45 07.2
28	Denebola	183 19.5	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.6	+61 59.8
14	Elnath	279 08.9	+28 34.3
47	Eltanin	91 07.2	+51 29.8
54	Enif	34 30.9	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.6	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.8	+74 20.6
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.9	−36 08.6
24	Miapl'dus	221 49.8	−69 31.3
9	Mirfak	309 44.1	+49 42.0
50	Nunki	76 53.8	−26 21.4
52	Peacock	54 29.5	−56 53.3
21	Pollux	244 22.3	+28 08.3
20	Procyon	245 46.5	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.2	+12 11.6
11	Rigel	281 54.8	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.3
45	Shaula	97 23.0	−37 04.5
18	Sirius	259 13.0	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.6	−43 14.4
49	Vega	81 09.5	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 25 h m	26 h m	27 h m	28 h m
72	8 20	4 19	▭	▭	▭	▭
70	8 01	4 26	▭	▭	▭	▭
68	7 45	4 31	▭	▭	▭	18 40
66	7 33	4 35	▭	▭	▭	19 33
64	7 23	4 39	15 03	16 08	18 12	20 05
62	7 14	4 41	16 15	17 18	18 50	20 29
60	7 06	4 44	16 51	17 54	19 17	20 47
58	7 00	4 45	17 17	18 19	19 38	21 03
56	6 54	4 47	17 37	18 40	19 55	21 16
54	6 48	4 47	17 55	18 57	20 10	21 27
52	6 44	4 49	18 09	19 11	20 22	21 37
50	6 39	4 50	18 22	19 24	20 33	21 46
45	6 30	4 50	18 48	19 50	20 57	22 05
40	6 22	4 50	19 09	20 10	21 15	22 20
35	6 15	4 49	19 27	20 27	21 31	22 34
30	6 09	4 48	19 42	20 42	21 44	22 45
20	5 59	4 44	20 07	21 07	22 07	23 04
10	5 49	4 38	20 29	21 29	22 27	23 21
0	5 41	4 31	20 50	21 49	22 45	23 36
10	5 32	4 20	21 11	22 09	23 03	23 52
20	5 22	4 07	21 33	22 31	23 23	24 08
30	5 11	3 47	21 59	22 56	23 45	24 27
35	5 04	3 35	22 14	23 11	23 58	24 38
40	4 57	3 18	22 32	23 28	24 14	0 14
45	4 48	2 58	22 53	23 48	24 32	0 32
50	4 38	2 31	23 20	24 14	0 14	0 54
52	4 33	2 16	23 33	24 26	0 26	1 05
54	4 28	1 58	23 48	24 41	0 41	1 17
56	4 22	1 35	24 06	0 06	0 57	1 30
58	4 15	1 01	24 27	0 27	1 17	1 46
60	4 07	////	24 55	0 55	1 41	2 05
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 25 h m	26 h m	27 h m	28 h m
72	15 06	19 03	▭	▭	▭	▭
70	15 26	18 57	▭	▭	▭	▭
68	15 41	18 52	▭	▭	▭	16 20
66	15 54	18 49	▭	▭	▭	15 26
64	16 04	18 45	14 02	15 03	14 58	14 53
62	16 13	18 43	12 50	13 52	14 19	14 29
60	16 21	18 41	12 14	13 17	13 52	14 10
58	16 28	18 40	11 49	12 51	13 30	13 53
56	16 33	18 38	11 28	12 31	13 13	13 40
54	16 39	18 38	11 11	12 14	12 58	13 28
52	16 44	18 37	10 57	11 59	12 45	13 17
50	16 48	18 36	10 44	11 46	12 33	13 08
45	16 58	18 36	10 18	11 20	12 10	12 48
40	17 06	18 37	9 57	10 59	11 50	12 31
35	17 12	18 37	9 40	10 42	11 34	12 18
30	17 19	18 39	9 25	10 27	11 20	12 06
20	17 29	18 43	9 00	10 01	10 56	11 45
10	17 39	18 50	8 38	9 39	10 36	11 27
0	17 47	18 57	8 18	9 19	10 16	11 10
10	17 56	19 08	7 58	8 58	9 57	10 53
20	18 06	19 23	7 36	8 36	9 36	10 35
30	18 18	19 43	7 11	8 10	9 12	10 13
35	18 24	19 55	6 56	7 55	8 57	10 01
40	18 32	20 12	6 39	7 37	8 41	9 46
45	18 40	20 32	6 18	7 16	8 21	9 29
50	18 51	21 01	5 53	6 49	7 56	9 08
52	18 56	21 17	5 40	6 36	7 43	8 58
54	19 02	21 36	5 26	6 21	7 30	8 46
56	19 08	22 00	5 09	6 03	7 13	8 33
58	19 15	22 36	4 49	5 41	6 54	8 17
60	19 22	////	4 25	5 14	6 30	7 59
S						

GMT h	Equation of Time (App.—Mean) 25 m s	26 m s	27 m s
0	+15 48.0	+15 55.0	+16 01.2
6	+15 49.8	+15 56.6	+16 02.7
12	+15 51.6	+15 58.2	+16 04.1
18	+15 53.3	+15 59.7	+16 05.4
24	+15 55.0	+16 01.2	+16 06.7

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
25	2 03	10 19	9 32	3 31	11 42
26	3 04	10 20	9 30	3 27	11 38
27	4 03	10 21	9 28	3 23	11 35
28	4 58	10 21	9 27	3 19	11 32

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	25 ′	26 ′	27 ′
0	18.2	17.1	15.8
4	18.2	17.1	15.8
8	18.2	17.1	15.8
12	18.2	17.0	15.8
16	18.1	17.0	15.8
20	18.1	17.0	15.8
24	18.0	17.0	15.8
28	17.9	16.9	15.8
32	17.9	16.9	15.8
36	17.8	16.8	15.8
40	17.7	16.8	15.8
44	17.6	16.7	15.7
48	17.5	16.6	15.7
52	17.4	16.6	15.7
56	17.2	16.5	15.7
60	17.1	16.4	15.7
64	17.0	16.4	15.7
68	16.8	16.3	15.7
72	16.7	16.2	15.7
76	16.6	16.1	15.6
80	16.4	16.0	15.6
84	16.3	16.0	15.6
88	16.2	15.9	15.6
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	25 ′	26 ′	27 ′
0	14.0	14.7	15.4
4	14.0	14.7	15.4
8	14.1	14.7	15.4
12	14.1	14.7	15.4
16	14.1	14.7	15.4
20	14.2	14.8	15.4
24	14.2	14.8	15.4
28	14.3	14.8	15.4
32	14.4	14.9	15.4
36	14.5	14.9	15.4
40	14.6	15.0	15.5
44	14.7	15.0	15.5
48	14.8	15.1	15.5
52	14.9	15.2	15.5
56	15.0	15.2	15.5
60	15.1	15.3	15.5
64	15.3	15.4	15.5
68	15.4	15.5	15.5
72	15.5	15.5	15.6
76	15.7	15.6	15.6
80	15.8	15.7	15.6
84	16.0	15.8	15.6
88	16.1	15.9	15.6
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.2 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
28 0	36 02.6	204 45.5	− 3 07.5	218 10.0	+ 2 17.5	310 09.9	+22 48.7	186 43.1	− 9 36.0	288 14.7	90	+23 28.2	− 68
1	51 05.0	219 45.1	08.7	233 11.0	16.9	325 12.5	48.7	201 45.3	36.1	302 42.7	90	23 21.4	− 68
2	66 07.5	234 44.7	09.9	248 12.1	16.2	340 15.1	48.7	216 47.5	36.3	317 10.7	92	23 14.6	− 70
3	81 10.0	249 44.3	•• 11.1	263 13.1	•• 15.6	355 17.6	•• 48.7	231 49.7	•• 36.4	331 38.9	92	•23 07.6	− 71
4	96 12.4	264 43.9	12.3	278 14.2	15.0	10 20.2	48.7	246 51.8	36.5	346 07.1	94	23 00.5	− 72
5	111 14.9	279 43.5	13.5	293 15.2	14.4	25 22.8	48.7	261 54.0	36.6	0 35.5	94	22 53.3	− 74
6	126 17.4	294 43.1	− 3 14.8	308 16.2	+ 2 13.8	40 25.4	+22 48.7	276 56.2	− 9 36.7	15 03.9	96	+22 45.9	− 74
7	141 19.8	309 42.7	16.0	323 17.3	13.1	55 28.0	48.7	291 58.4	36.8	29 32.5	97	22 38.5	− 75
8	156 22.3	324 42.3	17.2	338 18.3	12.5	70 30.5	48.7	307 00.5	36.9	44 01.2	98	22 31.0	− 77
9	171 24.7	339 41.9	•• 18.4	353 19.3	•• 11.9	85 33.1	•• 48.7	322 02.7	•• 37.0	58 30.0	99	•22 23.3	− 77
10	186 27.2	354 41.5	19.6	8 20.4	11.3	100 35.7	48.7	337 04.9	37.1	72 58.9	100	22 15.6	− 79
11	201 29.7	9 41.1	20.8	23 21.4	10.7	115 38.3	48.7	352 07.1	37.2	87 27.9	101	22 07.7	− 80
12	216 32.1	24 40.7	− 3 22.0	38 22.4	+ 2 10.1	130 40.9	+22 48.7	7 09.2	− 9 37.3	101 57.0	102	+21 59.7	− 80
13	231 34.6	39 40.3	23.2	53 23.5	09.4	145 43.5	48.7	22 11.4	37.4	116 26.2	103	21 51.7	− 82
14	246 37.1	54 39.9	24.4	68 24.5	08.8	160 46.1	48.7	37 13.6	37.5	130 55.5	104	21 43.5	− 83
15	261 39.5	69 39.5	•• 25.6	83 25.5	•• 08.2	175 48.6	•• 48.7	52 15.8	•• 37.6	145 24.9	105	•21 35.2	− 83
16	276 42.0	84 39.1	26.8	98 26.6	07.6	190 51.2	48.7	67 17.9	37.7	159 54.4	106	21 26.9	− 85
17	291 44.5	99 38.7	28.1	113 27.6	07.0	205 53.8	48.7	82 20.1	37.8	174 24.0	108	21 18.4	− 86
18	306 46.9	114 38.3	− 3 29.3	128 28.6	+ 2 06.3	220 56.4	+22 48.7	97 22.3	− 9 37.9	188 53.8	108	+21 09.8	− 86
19	321 49.4	129 37.9	30.5	143 29.7	05.7	235 59.0	48.7	112 24.5	38.0	203 23.6	109	21 01.2	− 87
20	336 51.9	144 37.5	31.7	158 30.7	05.1	251 01.6	48.7	127 26.7	38.1	217 53.5	111	20 52.5	− 89
21	351 54.3	159 37.1	•• 32.9	173 31.8	•• 04.5	266 04.2	•• 48.7	142 28.8	•• 38.2	232 23.6	111	•20 43.6	− 89
22	6 56.8	174 36.7	34.1	188 32.8	03.9	281 06.8	48.7	157 31.0	38.3	246 53.7	112	20 34.7	− 90
23	21 59.2	189 36.3	35.3	203 33.8	03.3	296 09.3	48.7	172 33.2	38.4	261 23.9	114	20 25.7	− 91
29 0	37 01.7	204 35.9	− 3 36.5	218 34.9	+ 2 02.6	311 11.9	+22 48.7	187 35.4	− 9 38.5	275 54.3	114	+20 16.6	− 92
1	52 04.2	219 35.5	37.7	233 35.9	02.0	326 14.5	48.7	202 37.5	38.7	290 24.7	116	20 07.4	− 93
2	67 06.6	234 35.1	38.9	248 36.9	01.4	341 17.1	48.7	217 39.7	38.8	304 55.3	116	19 58.1	− 94
3	82 09.1	249 34.7	•• 40.1	263 38.0	•• 00.8	356 19.7	•• 48.7	232 41.9	•• 38.9	319 25.9	117	•19 48.7	− 94
4	97 11.6	264 34.2	41.3	278 39.0	2 00.2	11 22.3	48.7	247 44.1	39.0	333 56.6	119	19 39.3	− 95
5	112 14.0	279 33.8	42.5	293 40.0	1 59.5	26 24.9	48.7	262 46.2	39.1	348 27.5	119	19 29.8	− 96
6	127 16.5	294 33.4	− 3 43.7	308 41.1	+ 1 58.9	41 27.5	+22 48.6	277 48.4	− 9 39.2	2 58.4	120	+19 20.2	− 97
7	142 19.0	309 33.0	45.0	323 42.1	58.3	56 30.1	48.6	292 50.6	39.3	17 29.4	122	19 10.5	− 98
8	157 21.4	324 32.6	46.2	338 43.1	57.7	71 32.7	48.6	307 52.8	39.4	32 00.6	122	19 00.7	− 98
9	172 23.9	339 32.2	•• 47.4	353 44.2	•• 57.1	86 35.3	•• 48.6	322 54.9	•• 39.5	46 31.8	123	•18 50.9	− 99
10	187 26.3	354 31.8	48.6	8 45.2	56.5	101 37.8	48.6	337 57.1	39.6	61 03.1	124	18 41.0	−100
11	202 28.8	9 31.4	49.8	23 46.3	55.8	116 40.4	48.6	352 59.3	39.7	75 34.5	125	18 31.0	−101
12	217 31.3	24 31.0	− 3 51.0	38 47.3	+ 1 55.2	131 43.0	+22 48.6	8 01.5	− 9 39.8	90 06.0	126	+18 20.9	−101
13	232 33.7	39 30.6	52.2	53 48.3	54.6	146 45.6	48.6	23 03.7	39.9	104 37.6	127	18 10.8	−102
14	247 36.2	54 30.2	53.4	68 49.4	54.0	161 48.2	48.6	38 05.8	40.0	119 09.3	128	18 00.6	−103
15	262 38.7	69 29.8	•• 54.6	83 50.4	•• 53.4	176 50.8	•• 48.6	53 08.0	•• 40.1	133 41.1	128	•17 50.3	−104
16	277 41.1	84 29.4	55.8	98 51.4	52.7	191 53.4	48.6	68 10.2	40.2	148 12.9	130	17 39.9	−104
17	292 43.6	99 29.0	57.0	113 52.5	52.1	206 56.0	48.6	83 12.4	40.3	162 44.9	130	17 29.5	−105
18	307 46.1	114 28.6	− 3 58.2	128 53.5	+ 1 51.5	221 58.6	+22 48.6	98 14.5	− 9 40.4	177 16.9	132	+17 19.0	−105
19	322 48.5	129 28.1	3 59.4	143 54.5	50.9	237 01.2	48.6	113 16.7	40.5	191 49.1	132	17 08.5	−106
20	337 51.0	144 27.7	4 00.6	158 55.6	50.3	252 03.8	48.6	128 18.9	40.6	206 21.3	133	16 57.9	−107
21	352 53.5	159 27.3	•• 01.8	173 56.6	•• 49.7	267 06.4	•• 48.6	143 21.1	•• 40.7	220 53.6	134	•16 47.2	−107
22	7 55.9	174 26.9	03.0	188 57.6	49.0	282 09.0	48.6	158 23.2	40.8	235 26.0	135	16 36.5	−108
23	22 58.4	189 26.5	04.3	203 58.7	48.4	297 11.6	48.6	173 25.4	40.9	249 58.5	135	16 25.7	−109
30 0	38 00.8	204 26.1	− 4 05.5	218 59.7	+ 1 47.8	312 14.2	+22 48.6	188 27.6	− 9 41.1	264 31.0	137	+16 14.8	−109
1	53 03.3	219 25.7	06.7	234 00.8	47.2	327 16.8	48.6	203 29.8	41.2	279 03.7	137	16 03.9	−110
2	68 05.8	234 25.3	07.9	249 01.8	46.6	342 19.4	48.6	218 31.9	41.3	293 36.4	138	15 52.9	−111
3	83 08.2	249 24.9	•• 09.1	264 02.8	•• 45.9	357 22.0	•• 48.6	233 34.1	•• 41.4	308 09.2	139	•15 41.8	−110
4	98 10.7	264 24.5	10.3	279 03.9	45.3	12 24.6	48.6	248 36.3	41.5	322 42.1	140	15 30.8	−112
5	113 13.2	279 24.1	11.5	294 04.9	44.7	27 27.2	48.6	263 38.5	41.6	337 15.1	140	15 19.6	−112
6	128 15.6	294 23.6	− 4 12.7	309 05.9	+ 1 44.1	42 29.8	+22 48.6	278 40.7	− 9 41.7	351 48.1	141	+15 08.4	−113
7	143 18.1	309 23.2	13.9	324 07.0	43.5	57 32.4	48.6	293 42.8	41.8	6 21.2	142	14 57.1	−113
8	158 20.6	324 22.8	15.1	339 08.0	42.9	72 35.0	48.6	308 45.0	41.9	20 54.4	143	14 45.8	−113
9	173 23.0	339 22.4	•• 16.3	354 09.0	•• 42.2	87 37.6	•• 48.6	323 47.2	•• 42.0	35 27.7	143	•14 34.5	−115
10	188 25.5	354 22.0	17.5	9 10.1	41.6	102 40.2	48.6	338 49.4	42.1	50 01.0	145	14 23.0	−114
11	203 28.0	9 21.6	18.7	24 11.1	41.0	117 42.8	48.6	353 51.5	42.2	64 34.5	145	14 11.6	−115
12	218 30.4	24 21.2	− 4 19.9	39 12.2	+ 1 40.4	132 45.4	+22 48.6	8 53.7	− 9 42.3	79 08.0	145	+14 00.1	−116
13	233 32.9	39 20.8	21.1	54 13.2	39.8	147 48.0	48.6	23 55.9	42.4	93 41.5	147	13 48.5	−116
14	248 35.3	54 20.4	22.3	69 14.2	39.1	162 50.6	48.6	38 58.1	42.5	108 15.2	147	13 36.9	−117
15	263 37.8	69 19.9	•• 23.5	84 15.3	•• 38.5	177 53.2	•• 48.6	54 00.2	•• 42.6	122 48.9	147	•13 25.2	−117
16	278 40.3	84 19.5	24.7	99 16.3	37.9	192 55.8	48.6	69 02.4	42.7	137 22.6	149	13 13.5	−117
17	293 42.7	99 19.1	25.9	114 17.3	37.3	207 58.4	48.6	84 04.6	42.8	151 56.5	149	13 01.8	−118
18	308 45.2	114 18.7	− 4 27.1	129 18.4	+ 1 36.7	223 01.0	+22 48.6	99 06.8	− 9 42.9	166 30.4	149	+12 50.0	−118
19	323 47.7	129 18.3	28.3	144 19.4	36.1	238 03.6	48.6	114 09.0	43.0	181 04.3	151	12 38.2	−119
20	338 50.1	144 17.9	29.5	159 20.5	35.4	253 06.2	48.6	129 11.1	43.1	195 38.4	151	12 26.3	−119
21	353 52.6	159 17.5	•• 30.7	174 21.5	•• 34.8	268 08.8	•• 48.6	144 13.3	•• 43.2	210 12.5	151	•12 14.4	−120
22	8 55.1	174 17.1	32.0	189 22.5	34.2	283 11.4	48.6	159 15.5	43.3	224 46.6	152	12 02.4	−119
23	23 57.5	189 16.6	33.2	204 23.6	33.6	298 14.0	48.6	174 17.7	43.4	239 20.8	153	11 50.5	−121
24	39 00.0	204 16.2	− 4 34.4	219 24.6	+ 1 33.0	313 16.6	+22 48.6	189 19.8	− 9 43.5	253 55.1	153	+11 38.4	−120
code	—	− 4	− 12	+ 10	− 6	+ 26	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
28 0	184 01.7	−12 56.9
1	199 01.8	57.8
2	214 01.8	58.6
3	229 01.9	−12 59.4
4	244 01.9	13 00.3
5	259 02.0	01.1
6	274 02.0	−13 02.0
7	289 02.1	02.8
8	304 02.1	03.6
9	319 02.2	04.5
10	334 02.2	05.3
11	349 02.3	06.2
12	4 02.3	−13 07.0
13	19 02.4	07.8
14	34 02.4	08.7
15	49 02.5	09.5
16	64 02.5	10.3
17	79 02.6	11.2
18	94 02.6	−13 12.0
19	109 02.7	12.8
20	124 02.7	13.7
21	139 02.7	14.5
22	154 02.8	15.4
23	169 02.8	16.2
29 0	184 02.9	−13 17.0
1	199 02.9	17.9
2	214 03.0	18.7
3	229 03.0	19.5
4	244 03.1	20.4
5	259 03.1	21.2
6	274 03.1	−13 22.0
7	289 03.2	22.8
8	304 03.2	23.7
9	319 03.3	24.5
10	334 03.3	25.3
11	349 03.4	26.2
12	4 03.4	−13 27.0
13	19 03.4	27.8
14	34 03.5	28.7
15	49 03.5	29.5
16	64 03.6	30.3
17	79 03.6	31.1
18	94 03.6	−13 32.0
19	109 03.7	32.8
20	124 03.7	33.6
21	139 03.8	34.4
22	154 03.8	35.3
23	169 03.8	36.1
30 0	184 03.9	−13 36.9
1	199 03.9	37.7
2	214 03.9	38.6
3	229 04.0	39.4
4	244 04.0	40.2
5	259 04.0	41.0
6	274 04.1	−13 41.9
7	289 04.1	42.7
8	304 04.1	43.5
9	319 04.2	44.3
10	334 04.2	45.2
11	349 04.2	46.0
12	4 04.3	−13 46.8
13	19 04.3	47.6
14	34 04.3	48.4
15	49 04.4	49.3
16	64 04.4	50.1
17	79 04.4	50.9
18	94 04.5	−13 51.7
19	109 04.5	52.5
20	124 04.5	53.3
21	139 04.6	54.2
22	154 04.6	55.0
23	169 04.6	55.8
24	184 04.6	−13 56.6
code	—	− 8

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.7	−40 29.1
5	Achernar	335 59.2	−57 28.1
30	Acrux	174 00.2	−62 50.5
19	Adhara	255 47.5	−28 54.2
10	Aldebaran	291 40.5	+16 25.3
32	Alioth	167 00.2	+56 12.5
34	Alkaid	153 34.4	+49 32.5
55	Al Na'ir	28 39.5	−47 11.2
15	Alnilam	276 31.5	− 1 13.6
25	Alphard	218 40.1	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.3	−42 33.3
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.0	−68 57.0
22	Avior	234 36.5	−59 21.3
13	Bellatrix	279 19.8	+ 6 18.7
16	Betelg'se	271 49.5	+ 7 24.2
17	Canopus	264 15.7	−52 39.8
12	Capella	281 40.3	+45 57.2
53	Deneb	50 02.0	+45 07.2
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.6	+61 59.8
14	Elnath	279 08.9	+28 34.3
47	Eltanin	91 07.3	+51 29.8
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.5	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.8	+74 20.6
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.9	−36 08.6
24	Miapl'dus	221 49.7	−69 31.3
9	Mirfak	309 44.1	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.5	−56 53.3
21	Pollux	244 22.3	+28 08.3
20	Procyon	245 46.4	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.2	+12 11.6
11	Rigel	281 54.8	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.5
18	Sirius	259 13.0	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.5	−43 14.4
49	Vega	81 09.5	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 28	29	30
h	m s	m s	m s
0	+16 06.7	+16 11.4	+16 15.4
6	+16 08.0	+16 12.5	+16 16.2
12	+16 09.2	+16 13.5	+16 17.0
18	+16 10.3	+16 14.5	+16 17.8
24	+16 11.4	+16 15.4	+16 18.5

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 28 h m	29 h m	30 h m	31 h m
72	8 37	4 32	▭	19 36	22 20	24 23
70	8 15	4 37	▭	20 32	22 42	24 33
68	7 58	4 41	18 40	21 05	22 59	24 41
66	7 44	4 44	19 33	21 29	23 12	24 47
64	7 32	4 47	20 05	21 48	23 23	24 53
62	7 22	4 48	20 29	22 03	23 32	24 58
60	7 14	4 50	20 47	22 16	23 40	25 02
58	7 07	4 51	21 03	22 27	23 47	25 05
56	7 00	4 52	21 16	22 36	23 54	25 09
54	6 54	4 53	21 27	22 44	23 59	25 11
52	6 49	4 53	21 37	22 52	24 04	0 04
50	6 44	4 54	21 46	22 59	24 08	0 08
45	6 34	4 54	22 05	23 13	24 18	0 18
40	6 25	4 53	22 20	23 24	24 26	0 26
35	6 18	4 52	22 34	23 34	24 33	0 33
30	6 11	4 50	22 45	23 43	24 39	0 39
20	6 00	4 46	23 04	23 58	24 49	0 49
10	5 50	4 39	23 21	24 11	0 11	0 58
0	5 40	4 30	23 36	24 23	0 23	1 07
10	5 31	4 19	23 52	24 35	0 35	1 15
20	5 20	4 04	24 08	0 08	0 48	1 24
30	5 08	3 44	24 27	0 27	1 03	1 34
35	5 01	3 30	24 38	0 38	1 11	1 40
40	4 53	3 13	0 14	0 50	1 21	1 47
45	4 44	2 52	0 32	1 05	1 32	1 54
50	4 32	2 21	0 54	1 23	1 45	2 03
52	4 27	2 06	1 05	1 32	1 52	2 07
54	4 21	1 45	1 17	1 41	1 59	2 12
56	4 15	1 19	1 30	1 52	2 06	2 17
58	4 07	0 34	1 46	2 04	2 15	2 23
60 S	3 59	////	2 05	2 18	2 25	2 29

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 28 h m	29 h m	30 h m	31 h m
72	14 49	18 50	▭	17 07	15 54	15 18
70	15 11	18 45	▭	16 08	15 31	15 06
68	15 29	18 42	16 20	15 34	15 12	14 56
66	15 43	18 39	15 26	15 09	14 57	14 48
64	15 54	18 37	14 53	14 49	14 45	14 41
62	16 04	18 35	14 29	14 33	14 35	14 35
60	16 13	18 34	14 10	14 20	14 25	14 29
58	16 20	18 33	13 53	14 08	14 18	14 25
56	16 27	18 33	13 40	13 58	14 11	14 20
54	16 32	18 31	13 28	13 49	14 04	14 17
52	16 38	18 32	13 17	13 41	13 59	14 13
50	16 43	18 32	13 08	13 33	13 53	14 10
45	16 53	18 32	12 48	13 18	13 42	14 03
40	17 02	18 33	12 31	13 05	13 33	13 57
35	17 09	18 34	12 18	12 54	13 25	13 52
30	17 16	18 37	12 06	12 44	13 18	13 48
20	17 27	18 42	11 45	12 28	13 06	13 40
10	17 38	18 49	11 27	12 13	12 55	13 33
0	17 47	18 58	11 10	11 59	12 44	13 27
10	17 57	19 09	10 53	11 45	12 34	13 20
20	18 08	19 25	10 35	11 30	12 23	13 13
30	18 20	19 46	10 13	11 13	12 10	13 05
35	18 27	19 59	10 01	11 03	12 03	13 00
40	18 35	20 16	9 46	10 52	11 54	12 55
45	18 45	20 39	9 29	10 38	11 44	12 49
50	18 56	21 10	9 08	10 21	11 32	12 41
52	19 02	21 27	8 58	10 13	11 27	12 38
54	19 07	21 47	8 46	10 04	11 21	12 34
56	19 14	22 16	8 33	9 54	11 14	12 30
58	19 22	23 08	8 17	9 43	11 06	12 25
60 S	19 30	////	7 59	9 30	10 57	12 20

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
28	4 58	10 21	9 27	3 19	11 32
29	5 48	10 22	9 25	3 15	11 28
30	6 34	10 23	9 23	3 11	11 25
31	7 17	10 23	9 22	3 06	11 21

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.0
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	28	29	30
°	′	′	′
0	14.7	13.8	12.9
4	14.7	13.8	12.9
8	14.7	13.8	12.9
12	14.7	13.8	12.9
16	14.7	13.8	13.0
20	14.7	13.9	13.0
24	14.7	13.9	13.1
28	14.8	14.0	13.2
32	14.8	14.0	13.2
36	14.8	14.1	13.3
40	14.8	14.1	13.4
44	14.9	14.2	13.5
48	14.9	14.3	13.6
52	14.9	14.3	13.7
56	15.0	14.4	13.9
60	15.0	14.5	14.0
64	15.1	14.6	14.1
68	15.1	14.7	14.3
72	15.2	14.8	14.4
76	15.2	14.9	14.5
80	15.3	15.0	14.7
84	15.3	15.1	14.8
88	15.3	15.1	14.9
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	28	29	30
°	′	′	′
0	16.1	16.6	17.1
4	16.1	16.6	17.1
8	16.0	16.5	17.0
12	16.0	16.5	17.0
16	16.0	16.5	17.0
20	16.0	16.5	16.9
24	16.0	16.4	16.9
28	16.0	16.4	16.8
32	15.9	16.3	16.7
36	15.9	16.3	16.6
40	15.9	16.2	16.5
44	15.8	16.1	16.4
48	15.8	16.1	16.3
52	15.8	16.0	16.2
56	15.7	15.9	16.1
60	15.7	15.8	16.0
64	15.6	15.7	15.8
68	15.6	15.6	15.7
72	15.6	15.6	15.6
76	15.5	15.5	15.4
80	15.5	15.4	15.3
84	15.4	15.3	15.1
88	15.4	15.2	15.0
90			

Subtract from table, back cover

Last Quarter 29

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.2 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
31 0	39 00.0	204 16.2	− 4 34.4	219 24.6	+ 1 33.0	313 16.6	+22 48.6	189 19.8	− 9 43.5	253 55.1	153	+11 38.4	−120
1	54 02.4	219 15.8	35.6	234 25.6	32.3	328 19.2	48.5	204 22.0	43.6	268 29.4	154	11 26.4	−122
2	69 04.9	234 15.4	36.8	249 26.7	31.7	343 21.9	48.5	219 24.2	43.8	283 03.8	155	11 14.2	−121
3	84 07.4	249 15.0	38.0	264 27.7	31.1	358 24.5	48.5	234 26.4	43.9	297 38.3	155	11 02.1	−122
4	99 09.8	264 14.6	39.2	279 28.8	30.5	13 27.1	48.5	249 28.5	44.0	312 12.8	156	10 49.9	−122
5	114 12.3	279 14.2	40.4	294 29.8	29.9	28 29.7	48.5	264 30.7	44.1	326 47.4	156	10 37.7	−122
6	129 14.8	294 13.7	− 4 41.6	309 30.8	+ 1 29.3	43 32.3	+22 48.5	279 32.9	− 9 44.2	341 22.0	156	+10 25.5	−123
7	144 17.2	309 13.3	42.8	324 31.9	28.6	58 34.9	48.5	294 35.1	44.3	355 56.6	158	10 13.2	−123
8	159 19.7	324 12.9	44.0	339 32.9	28.0	73 37.5	48.5	309 37.3	44.4	10 31.4	157	10 00.9	−124
9	174 22.2	339 12.5	45.2	354 33.9	27.4	88 40.1	48.5	324 39.4	44.5	25 06.1	159	9 48.5	−123
10	189 24.6	354 12.1	46.4	9 35.0	26.8	103 42.7	48.5	339 41.6	44.6	39 41.0	158	9 36.2	−124
11	204 27.1	9 11.7	47.6	24 36.0	26.2	118 45.3	48.5	354 43.8	44.7	54 15.8	159	9 23.8	−125
12	219 29.6	24 11.2	− 4 48.8	39 37.1	+ 1 25.5	133 48.0	+22 48.5	9 46.0	− 9 44.8	68 50.7	160	+ 9 11.3	−124
13	234 32.0	39 10.8	50.0	54 38.1	24.9	148 50.6	48.5	24 48.1	44.9	83 25.7	160	8 58.9	−125
14	249 34.5	54 10.4	51.2	69 39.1	24.3	163 53.2	48.5	39 50.3	45.0	98 00.7	161	8 46.4	−125
15	264 36.9	69 10.0	52.4	84 40.2	23.7	178 55.8	48.5	54 52.5	45.1	112 35.8	161	8 33.9	−126
16	279 39.4	84 09.6	53.6	99 41.2	23.1	193 58.4	48.5	69 54.7	45.2	127 10.9	161	8 21.3	−125
17	294 41.9	99 09.2	54.8	114 42.2	22.5	209 01.0	48.5	84 56.8	45.3	141 46.0	162	8 08.8	−126
18	309 44.3	114 08.7	− 4 56.0	129 43.3	+ 1 21.8	224 03.6	+22 48.5	99 59.0	− 9 45.4	156 21.2	162	+ 7 56.2	−126
19	324 46.8	129 08.3	57.2	144 44.3	21.2	239 06.2	48.5	115 01.2	45.5	170 56.4	162	7 43.6	−126
20	339 49.3	144 07.9	58.4	159 45.4	20.6	254 08.9	48.5	130 03.4	45.6	185 31.6	163	7 31.0	−127
21	354 51.7	159 07.5	− 4 59.6	174 46.4	20.0	269 11.5	48.5	145 05.5	45.7	200 06.9	164	7 18.3	−127
22	9 54.2	174 07.1	5 00.8	189 47.4	19.4	284 14.1	48.5	160 07.7	45.8	214 42.3	163	7 05.6	−127
23	24 56.7	189 06.7	02.0	204 48.5	18.7	299 16.7	48.5	175 09.9	45.9	229 17.6	164	6 52.9	−127
1 0	39 59.1	204 06.2	− 5 03.2	219 49.5	+ 1 18.1	314 19.3	+22 48.5	190 12.1	− 9 46.0	243 53.0	165	+ 6 40.2	−127
1	55 01.6	219 05.8	04.4	234 50.5	17.5	329 21.9	48.5	205 14.3	46.1	258 28.5	164	6 27.5	−128
2	70 04.1	234 05.4	05.6	249 51.6	16.9	344 24.5	48.5	220 16.4	46.2	273 03.9	165	6 14.7	−128
3	85 06.5	249 05.0	06.8	264 52.6	16.3	359 27.2	48.5	235 18.6	46.3	287 39.4	166	6 01.9	−128
4	100 09.0	264 04.6	08.0	279 53.7	15.7	14 29.8	48.5	250 20.8	46.4	302 15.0	165	5 49.1	−128
5	115 11.4	279 04.1	09.2	294 54.7	15.0	29 32.4	48.5	265 23.0	46.5	316 50.5	166	5 36.3	−128
6	130 13.9	294 03.7	− 5 10.4	309 55.7	+ 1 14.4	44 35.0	+22 48.5	280 25.1	− 9 46.6	331 26.1	166	+ 5 23.5	−128
7	145 16.4	309 03.3	11.6	324 56.8	13.8	59 37.6	48.5	295 27.3	46.8	346 01.7	167	5 10.7	−129
8	160 18.8	324 02.9	12.8	339 57.8	13.2	74 40.3	48.5	310 29.5	46.9	0 37.4	167	4 57.8	−129
9	175 21.3	339 02.5	14.0	354 58.8	12.6	89 42.9	48.5	325 31.7	47.0	15 13.1	166	4 44.9	−129
10	190 23.8	354 02.0	15.2	9 59.9	11.9	104 45.5	48.5	340 33.8	47.1	29 48.7	168	4 32.0	−128
11	205 26.2	9 01.6	16.4	25 00.9	11.3	119 48.1	48.5	355 36.0	47.2	44 24.5	167	4 19.2	−130
12	220 28.7	24 01.2	− 5 17.6	40 02.0	+ 1 10.7	134 50.7	+22 48.5	10 38.2	− 9 47.3	59 00.2	168	+ 4 06.2	−129
13	235 31.2	39 00.8	18.8	55 03.0	10.1	149 53.3	48.5	25 40.4	47.4	73 36.0	167	3 53.3	−129
14	250 33.6	54 00.4	20.0	70 04.0	09.5	164 56.0	48.5	40 42.6	47.5	88 11.7	168	3 40.4	−129
15	265 36.1	68 59.9	21.2	85 05.1	08.9	179 58.6	48.4	55 44.7	47.6	102 47.5	169	3 27.5	−130
16	280 38.5	83 59.5	22.4	100 06.1	08.2	195 01.2	48.4	70 46.9	47.7	117 23.4	168	3 14.5	−130
17	295 41.0	98 59.1	23.6	115 07.1	07.6	210 03.8	48.4	85 49.1	47.8	131 59.2	168	3 01.5	−129
18	310 43.5	113 58.7	− 5 24.7	130 08.2	+ 1 07.0	225 06.5	+22 48.4	100 51.3	− 9 47.9	146 35.0	169	+ 2 48.6	−130
19	325 45.9	128 58.2	25.9	145 09.2	06.4	240 09.1	48.4	115 53.4	48.0	161 10.9	169	2 35.6	−130
20	340 48.4	143 57.8	27.1	160 10.3	05.8	255 11.7	48.4	130 55.6	48.1	175 46.8	169	2 22.6	−130
21	355 50.9	158 57.4	28.3	175 11.3	05.1	270 14.3	48.4	145 57.8	48.2	190 22.7	169	2 09.6	−129
22	10 53.3	173 57.0	29.5	190 12.3	04.5	285 16.9	48.4	161 00.0	48.3	204 58.6	169	1 56.7	−130
23	25 55.8	188 56.5	30.7	205 13.4	03.9	300 19.6	48.4	176 02.2	48.4	219 34.5	169	1 43.7	−130
2 0	40 58.3	203 56.1	− 5 31.9	220 14.4	+ 1 03.3	315 22.2	+22 48.4	191 04.3	− 9 48.5	234 10.4	169	+ 1 30.7	−130
1	56 00.7	218 55.7	33.1	235 15.5	02.7	330 24.8	48.4	206 06.5	48.6	248 46.3	170	1 17.7	−130
2	71 03.2	233 55.3	34.3	250 16.5	02.1	345 27.4	48.4	221 08.7	48.7	263 22.3	169	1 04.7	−131
3	86 05.7	248 54.9	35.5	265 17.5	01.4	0 30.1	48.4	236 10.9	48.8	277 58.2	170	0 51.6	−130
4	101 08.1	263 54.4	36.7	280 18.6	00.8	15 32.7	48.4	251 13.0	48.9	292 34.2	169	0 38.6	−130
5	116 10.6	278 54.0	37.9	295 19.6	1 00.2	30 35.3	48.4	266 15.2	49.0	307 10.1	170	0 25.6	−130
6	131 13.0	293 53.6	− 5 39.1	310 20.6	+ 0 59.6	45 37.9	+22 48.4	281 17.4	− 9 49.1	321 46.1	169	+ 0 12.6	−130
7	146 15.5	308 53.2	40.3	325 21.7	59.0	60 40.6	48.4	296 19.6	49.2	336 22.0	170	− 0 00.4	−130
8	161 18.0	323 52.7	41.5	340 22.7	58.3	75 43.2	48.4	311 21.7	49.3	350 58.0	170	0 13.4	−130
9	176 20.4	338 52.3	42.7	355 23.8	57.7	90 45.8	48.4	326 23.9	49.4	5 34.0	169	0 26.4	−130
10	191 22.9	353 51.9	43.9	10 24.8	57.1	105 48.5	48.4	341 26.1	49.5	20 09.9	170	0 39.4	−130
11	206 25.4	8 51.4	45.1	25 25.8	56.5	120 51.1	48.4	356 28.3	49.6	34 45.9	170	0 52.4	−130
12	221 27.8	23 51.0	− 5 46.3	40 26.9	+ 0 55.9	135 53.7	+22 48.4	11 30.5	− 9 49.7	49 21.9	169	− 1 05.4	−130
13	236 30.3	38 50.6	47.5	55 27.9	55.3	150 56.3	48.4	26 32.6	49.8	63 57.8	170	1 18.4	−130
14	251 32.8	53 50.2	48.6	70 29.0	54.6	165 59.0	48.4	41 34.8	49.9	78 33.8	169	1 31.4	−130
15	266 35.2	68 49.7	49.8	85 30.0	54.0	181 01.6	48.4	56 37.0	50.0	93 09.7	170	1 44.4	−129
16	281 37.7	83 49.3	51.0	100 31.0	53.4	196 04.2	48.4	71 39.2	50.1	107 45.7	169	1 57.3	−130
17	296 40.1	98 48.9	52.2	115 32.1	52.8	211 06.9	48.4	86 41.3	50.3	122 21.6	169	2 10.3	−130
18	311 42.6	113 48.4	− 5 53.4	130 33.1	+ 0 52.2	226 09.5	+22 48.4	101 43.5	− 9 50.4	136 57.5	170	− 2 23.3	−129
19	326 45.1	128 48.0	54.6	145 34.2	51.6	241 12.1	48.4	116 45.7	50.5	151 33.5	169	2 36.2	−130
20	341 47.5	143 47.6	55.8	160 35.2	50.9	256 14.8	48.4	131 47.9	50.6	166 09.4	169	2 49.2	−129
21	356 50.0	158 47.2	57.0	175 36.2	50.3	271 17.4	48.4	146 50.1	50.7	180 45.3	168	3 02.1	−129
22	11 52.5	173 46.7	58.2	190 37.3	49.7	286 20.0	48.4	161 52.2	50.8	195 21.1	169	3 15.0	−129
23	26 54.9	188 46.3	5 59.4	205 38.3	49.1	301 22.6	48.4	176 54.4	50.9	209 57.0	169	3 27.9	−129
24	41 57.4	203 45.9	− 6 00.6	220 39.4	+ 0 48.5	316 25.3	+22 48.3	191 56.6	− 9 51.0	224 32.9	168	− 3 40.8	−129
code	—	− 4	− 12	+ 10	− 6	+ 26	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
31 0h	184 04.6	−13 56.6
1	199 04.7	57.4
2	214 04.7	58.2
3	229 04.7	59.1
4	244 04.8	13 59.9
5	259 04.8	14 00.7
6	274 04.8	−14 01.5
7	289 04.8	02.3
8	304 04.9	03.1
9	319 04.9	03.9
10	334 04.9	04.8
11	349 04.9	05.6
12	4 05.0	−14 06.4
13	19 05.0	07.2
14	34 05.0	08.0
15	49 05.0	08.8
16	64 05.1	09.6
17	79 05.1	10.4
18	94 05.1	−14 11.2
19	109 05.1	12.0
20	124 05.1	12.9
21	139 05.2	13.7
22	154 05.2	14.5
23	169 05.2	15.3
1 0h	184 05.2	−14 16.1
1	199 05.2	16.9
2	214 05.3	17.7
3	229 05.3	18.5
4	244 05.3	19.3
5	259 05.3	20.1
6	274 05.3	−14 20.9
7	289 05.4	21.7
8	304 05.4	22.5
9	319 05.4	23.3
10	334 05.4	24.1
11	349 05.4	24.9
12	4 05.4	−14 25.7
13	19 05.5	26.5
14	34 05.5	27.3
15	49 05.5	28.1
16	64 05.5	28.9
17	79 05.5	29.7
18	94 05.5	−14 30.5
19	109 05.5	31.3
20	124 05.6	32.1
21	139 05.6	32.9
22	154 05.6	33.7
23	169 05.6	34.5
2 0h	184 05.6	−14 35.3
1	199 05.6	36.1
2	214 05.6	36.9
3	229 05.6	37.7
4	244 05.7	38.5
5	259 05.7	39.3
6	274 05.7	−14 40.1
7	289 05.7	40.9
8	304 05.7	41.7
9	319 05.7	42.5
10	334 05.7	43.3
11	349 05.7	44.1
12	4 05.7	−14 44.9
13	19 05.7	45.6
14	34 05.7	46.4
15	49 05.7	47.2
16	64 05.8	48.0
17	79 05.8	48.8
18	94 05.8	−14 49.6
19	109 05.8	50.4
20	124 05.8	51.2
21	139 05.8	52.0
22	154 05.8	52.8
23	169 05.8	53.5
24	184 05.8	−14 54.3
code	—	− 8

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.7	−40 29.1
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.2	−62 50.5
19	Adhara	255 47.5	−28 54.2
10	Aldebaran	291 40.4	+16 25.3
32	Alioth	167 00.2	+56 12.4
34	Alkaid	153 34.4	+49 32.5
55	Al Na'ir	28 39.5	−47 11.2
15	Alnilam	276 31.5	− 1 13.6
25	Alphard	218 40.1	− 8 27.3
41	Alphecca	126 49.2	+26 52.2
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 51.9	+ 8 44.8
2	Ankaa	353 59.3	−42 33.3
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.1	−68 57.0
22	Avior	234 36.4	−59 21.3
13	Bellatrix	279 19.7	+ 6 18.7
16	Betelg'se	271 49.5	+ 7 24.2
17	Canopus	264 15.7	−52 39.8
12	Capella	281 40.2	+45 57.2
53	Deneb	50 02.1	+45 07.2
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.6	+61 59.8
14	Elnath	279 08.9	+28 34.3
47	Eltanin	91 07.3	+51 29.8
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.5	−56 51.2
29	Gienah	176 38.7	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.8	+74 20.6
57	Markab	14 22.7	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.7	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.6	−56 53.3
21	Pollux	244 22.2	+28 08.3
20	Procyon	245 46.4	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.2	+12 11.6
11	Rigel	281 54.8	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.5
18	Sirius	259 13.0	−16 38.8
33	Spica	159 18.8	−10 55.2
23	Suhail	223 25.5	−43 14.4
49	Vega	81 09.5	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 31	1	2
h	m s	m s	m s
0	+16 18.5	+16 20.9	+16 22.4
6	+16 19.2	+16 21.3	+16 22.7
12	+16 19.8	+16 21.7	+16 22.9
18	+16 20.4	+16 22.1	+16 23.0
24	+16 20.9	+16 22.4	+16 23.1

Lat. N°	Sunrise h m	Twlt. begins h m	Moonrise 31 h m	1 h m	2 h m	3 h m
72	8 55	4 44	24 23	0 23	2 16	4 07
70	8 30	4 48	24 33	0 33	2 17	4 00
68	8 10	4 51	24 41	0 41	2 18	3 54
66	7 54	4 53	24 47	0 47	2 19	3 50
64	7 42	4 54	24 53	0 53	2 20	3 46
62	7 31	4 56	24 58	0 58	2 20	3 43
60	7 22	4 57	25 02	1 02	2 21	3 40
58	7 14	4 57	25 05	1 05	2 21	3 37
56	7 06	4 58	25 09	1 09	2 22	3 35
54	7 00	4 58	25 11	1 11	2 22	3 33
52	6 54	4 59	0 04	1 14	2 23	3 31
50	6 49	4 59	0 08	1 16	2 23	3 29
45	6 38	4 58	0 18	1 22	2 24	3 26
40	6 29	4 56	0 26	1 26	2 24	3 23
35	6 21	4 54	0 33	1 30	2 25	3 20
30	6 14	4 52	0 39	1 33	2 25	3 18
20	6 01	4 46	0 49	1 38	2 26	3 14
10	5 50	4 38	0 58	1 43	2 27	3 10
0	5 40	4 29	1 07	1 48	2 28	3 07
10	5 30	4 17	1 15	1 52	2 28	3 04
20	5 19	4 02	1 24	1 57	2 29	3 01
30	5 06	3 41	1 34	2 03	2 30	2 57
35	4 58	3 26	1 40	2 06	2 31	2 55
40	4 49	3 09	1 47	2 09	2 31	2 52
45	4 39	2 46	1 54	2 14	2 32	2 50
50	4 27	2 13	2 03	2 19	2 33	2 46
52	4 21	1 55	2 07	2 21	2 33	2 45
54	4 15	1 33	2 12	2 23	2 33	2 43
56	4 08	1 00	2 17	2 26	2 34	2 42
58	4 00	////	2 23	2 29	2 34	2 40
60	3 50	////	2 29	2 32	2 35	2 37
S						

Lat. N°	Sunset h m	Twlt. ends h m	Moonset 31 h m	1 h m	2 h m	3 h m
72	14 30	18 38	15 18	14 51	14 25	13 59
70	14 56	18 34	15 06	14 46	14 28	14 08
68	15 16	18 32	14 56	14 42	14 29	14 16
66	15 32	18 31	14 48	14 39	14 31	14 23
64	15 45	18 29	14 41	14 37	14 32	14 28
62	15 55	18 28	14 35	14 34	14 33	14 33
60	16 05	18 28	14 29	14 32	14 35	14 37
58	16 13	18 27	14 25	14 30	14 35	14 41
56	16 20	18 27	14 20	14 29	14 36	14 44
54	16 26	18 26	14 17	14 27	14 37	14 47
52	16 32	18 27	14 13	14 26	14 38	14 50
50	16 37	18 27	14 10	14 24	14 38	14 52
45	16 49	18 28	14 03	14 22	14 40	14 58
40	16 58	18 30	13 57	14 19	14 41	15 03
35	17 06	18 32	13 52	14 17	14 42	15 06
30	17 13	18 34	13 48	14 16	14 43	15 10
20	17 26	18 41	13 40	14 12	14 44	15 16
10	17 37	18 49	13 33	14 10	14 45	15 21
0	17 47	18 58	13 27	14 07	14 47	15 26
10	17 58	19 11	13 20	14 04	14 48	15 32
20	18 09	19 27	13 13	14 02	14 49	15 37
30	18 22	19 49	13 05	13 58	14 51	15 43
35	18 30	20 03	13 00	13 56	14 51	15 47
40	18 39	20 22	12 55	13 54	14 53	15 51
45	18 49	20 45	12 49	13 52	14 54	15 56
50	19 02	21 20	12 41	13 49	14 55	16 01
52	19 07	21 37	12 38	13 47	14 56	16 04
54	19 14	22 02	12 34	13 46	14 56	16 07
56	19 21	22 37	12 30	13 44	14 57	16 10
58	19 29	////	12 25	13 42	14 58	16 14
60	19 39	////	12 20	13 40	14 59	16 18
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
31	7 17	10 23	9 22	3 06	11 21
1	7 57	10 24	9 20	3 02	11 18
2	8 37	10 25	9 18	2 58	11 14
3	9 17	10 25	9 17	2 54	11 11

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.4	0.1	0.1
30	0.4	0.1	0.1
45	0.4	0.1	0.0
60	0.4	0.0	0.0
75	0.4	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	31	1	2
°	′	′	′
0	12.4	12.0	11.7
4	12.4	12.0	11.7
8	12.4	12.0	11.8
12	12.4	12.1	11.8
16	12.5	12.1	11.9
20	12.6	12.2	12.0
24	12.6	12.3	12.0
28	12.7	12.4	12.1
32	12.8	12.5	12.2
36	12.9	12.6	12.4
40	13.0	12.7	12.5
44	13.1	12.8	12.6
48	13.3	13.0	12.8
52	13.4	13.1	13.0
56	13.5	13.3	13.1
60	13.7	13.5	13.3
64	13.9	13.6	13.5
68	14.0	13.8	13.7
72	14.2	14.0	13.9
76	14.4	14.2	14.1
80	14.5	14.4	14.3
84	14.7	14.6	14.5
88	14.8	14.7	14.7
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	31	1	2
°	′	′	′
0	17.4	17.6	17.7
4	17.4	17.6	17.7
8	17.3	17.5	17.7
12	17.3	17.5	17.6
16	17.2	17.5	17.6
20	17.2	17.4	17.5
24	17.1	17.3	17.4
28	17.0	17.2	17.3
32	16.9	17.1	17.2
36	16.8	17.0	17.1
40	16.7	16.9	17.0
44	16.6	16.7	16.8
48	16.5	16.6	16.7
52	16.3	16.4	16.5
56	16.2	16.3	16.3
60	16.0	16.1	16.1
64	15.9	15.9	16.0
68	15.7	15.7	15.8
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	14.9
88	14.9	14.8	14.8
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 2.0 GHA	Dec.	JUPITER −2.2 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
3 0	41 57.4	203 45.9	− 6 00.6	220 39.4	+ 0 48.5	316 25.3	+22 48.3	191 56.6	− 9 51.0	224 32.9	168	− 3 40.8	−129
1	56 59.9	218 45.4	01.8	235 40.4	47.8	331 27.9	48.3	206 58.8	51.1	239 08.7	168	3 53.7	−129
2	72 02.3	233 45.0	03.0	250 41.4	47.2	346 30.5	48.3	222 00.9	51.2	253 44.5	168	4 06.6	−128
3	87 04.8	248 44.6	•• 04.1	265 42.5	•• 46.6	1 33.2	•• 48.3	237 03.1	•• 51.3	268 20.3	168	• 4 19.4	−129
4	102 07.3	263 44.2	05.3	280 43.5	46.0	16 35.8	48.3	252 05.3	51.4	282 56.1	168	4 32.3	−128
5	117 09.7	278 43.7	06.5	295 44.5	45.4	31 38.4	48.3	267 07.5	51.5	297 31.9	168	4 45.1	−128
6	132 12.2	293 43.3	− 6 07.7	310 45.6	+ 0 44.8	46 41.1	+22 48.3	282 09.6	− 9 51.6	312 07.7	167	− 4 57.9	−128
7	147 14.6	308 42.9	08.9	325 46.6	44.1	61 43.7	48.3	297 11.8	51.7	326 43.4	167	5 10.7	−128
8	162 17.1	323 42.4	10.1	340 47.7	43.5	76 46.4	48.3	312 14.0	51.8	341 19.1	167	5 23.5	−128
9	177 19.6	338 42.0	•• 11.3	355 48.7	•• 42.9	91 49.0	•• 48.3	327 16.2	•• 51.9	355 54.8	167	• 5 36.3	−127
10	192 22.0	353 41.6	12.5	10 49.7	42.3	106 51.6	48.3	342 18.4	52.0	10 30.5	166	5 49.0	−127
11	207 24.5	8 41.1	13.7	25 50.8	41.7	121 54.3	48.3	357 20.5	52.1	25 06.1	166	6 01.7	−127
12	222 27.0	23 40.7	− 6 14.9	40 51.8	+ 0 41.1	136 56.9	+22 48.3	12 22.7	− 9 52.2	39 41.7	166	− 6 14.4	−127
13	237 29.4	38 40.3	16.0	55 52.9	40.4	151 59.5	48.3	27 24.9	52.3	54 17.3	166	6 27.1	−127
14	252 31.9	53 39.8	17.2	70 53.9	39.8	167 02.2	48.3	42 27.1	52.4	68 52.9	165	6 39.8	−126
15	267 34.4	68 39.4	•• 18.4	85 54.9	•• 39.2	182 04.8	•• 48.3	57 29.2	•• 52.5	83 28.4	165	• 6 52.4	−126
16	282 36.8	83 39.0	19.6	100 56.0	38.6	197 07.5	48.3	72 31.4	52.6	98 03.9	165	7 05.0	−126
17	297 39.3	98 38.5	20.8	115 57.0	38.0	212 10.1	48.3	87 33.6	52.7	112 39.4	164	7 17.6	−126
18	312 41.8	113 38.1	− 6 22.0	130 58.1	+ 0 37.3	227 12.7	+22 48.3	102 35.8	− 9 52.8	127 14.8	164	− 7 30.2	−125
19	327 44.2	128 37.7	23.2	145 59.1	36.7	242 15.4	48.3	117 38.0	52.9	141 50.2	164	7 42.7	−125
20	342 46.7	143 37.2	24.4	161 00.1	36.1	257 18.0	48.3	132 40.1	53.0	156 25.6	164	7 55.2	−125
21	357 49.1	158 36.8	•• 25.5	176 01.2	•• 35.5	272 20.6	•• 48.3	147 42.3	•• 53.1	171 01.0	163	• 8 07.7	−125
22	12 51.6	173 36.4	26.7	191 02.2	34.9	287 23.3	48.3	162 44.5	53.2	185 36.3	163	8 20.2	−124
23	27 54.1	188 35.9	27.9	206 03.3	34.3	302 25.9	48.3	177 46.7	53.3	200 11.6	162	8 32.6	−124
4 0	42 56.5	203 35.5	− 6 29.1	221 04.3	+ 0 33.6	317 28.6	+22 48.3	192 48.8	− 9 53.4	214 46.8	162	− 8 45.0	−124
1	57 59.0	218 35.0	30.3	236 05.3	33.0	332 31.2	48.3	207 51.0	53.5	229 22.0	162	8 57.4	−123
2	73 01.5	233 34.6	31.5	251 06.4	32.4	347 33.9	48.3	222 53.2	53.6	243 57.2	161	9 09.7	−123
3	88 03.9	248 34.2	•• 32.7	266 07.4	•• 31.8	2 36.5	•• 48.3	237 55.4	•• 53.7	258 32.3	161	• 9 22.0	−123
4	103 06.4	263 33.7	33.9	281 08.5	31.2	17 39.1	48.3	252 57.6	53.8	273 07.4	160	9 34.3	−123
5	118 08.9	278 33.3	35.0	296 09.5	30.6	32 41.8	48.3	267 59.7	53.9	287 42.4	160	9 46.6	−122
6	133 11.3	293 32.9	− 6 36.2	311 10.5	+ 0 29.9	47 44.4	+22 48.3	283 01.9	− 9 54.0	302 17.4	160	− 9 58.8	−122
7	148 13.8	308 32.4	37.4	326 11.6	29.3	62 47.1	48.2	298 04.1	54.1	316 52.4	159	10 11.0	−121
8	163 16.2	323 32.0	38.6	341 12.6	28.7	77 49.7	48.2	313 06.3	54.2	331 27.3	159	10 23.1	−121
9	178 18.7	338 31.5	•• 39.8	356 13.7	•• 28.1	92 52.4	•• 48.2	328 08.4	•• 54.3	346 02.2	158	• 10 35.2	−121
10	193 21.2	353 31.1	41.0	11 14.7	27.5	107 55.0	48.2	343 10.6	54.4	0 37.0	158	10 47.3	−120
11	208 23.6	8 30.7	42.1	26 15.7	26.9	122 57.6	48.2	358 12.8	54.5	15 11.8	157	10 59.3	−120
12	223 26.1	23 30.2	− 6 43.3	41 16.8	+ 0 26.2	138 00.3	+22 48.2	13 15.0	− 9 54.7	29 46.5	157	− 11 11.3	−120
13	238 28.6	38 29.8	44.5	56 17.8	25.6	153 02.9	48.2	28 17.2	54.8	44 21.2	157	11 23.3	−119
14	253 31.0	53 29.4	45.7	71 18.9	25.0	168 05.6	48.2	43 19.3	54.9	58 55.9	156	11 35.2	−119
15	268 33.5	68 28.9	•• 46.9	86 19.9	•• 24.4	183 08.2	•• 48.2	58 21.5	•• 55.0	73 30.5	155	• 11 47.1	−118
16	283 36.0	83 28.5	48.1	101 20.9	23.8	198 10.9	48.2	73 23.7	55.1	88 05.0	155	11 58.9	−118
17	298 38.4	98 28.0	49.2	116 22.0	23.2	213 13.5	48.2	88 25.9	55.2	102 39.5	155	12 10.7	−117
18	313 40.9	113 27.6	− 6 50.4	131 23.0	+ 0 22.5	228 16.2	+22 48.2	103 28.0	− 9 55.3	117 14.0	153	− 12 22.4	−117
19	328 43.4	128 27.1	51.6	146 24.1	21.9	243 18.8	48.2	118 30.2	55.4	131 48.3	154	12 34.1	−117
20	343 45.8	143 26.7	52.8	161 25.1	21.3	258 21.5	48.2	133 32.4	55.5	146 22.7	153	12 45.8	−116
21	358 48.3	158 26.3	•• 54.0	176 26.1	•• 20.7	273 24.1	•• 48.2	148 34.6	•• 55.6	160 57.0	152	• 12 57.4	−116
22	13 50.7	173 25.8	55.2	191 27.2	20.1	288 26.8	48.2	163 36.8	55.7	175 31.2	152	13 09.0	−115
23	28 53.2	188 25.4	56.3	206 28.2	19.4	303 29.4	48.2	178 38.9	55.8	190 05.4	151	13 20.5	−114
5 0	43 55.7	203 24.9	− 6 57.5	221 29.3	+ 0 18.8	318 32.1	+22 48.2	193 41.1	− 9 55.9	204 39.5	151	− 13 31.9	−115
1	58 58.1	218 24.5	58.7	236 30.3	18.2	333 34.7	48.2	208 43.3	56.0	219 13.6	150	13 43.4	−113
2	74 00.6	233 24.1	6 59.9	251 31.3	17.6	348 37.4	48.2	223 45.5	56.1	233 47.6	149	13 54.7	−113
3	89 03.1	248 23.6	• 7 01.1	266 32.4	•• 17.0	3 40.0	•• 48.2	238 47.7	•• 56.2	248 21.5	149	• 14 06.0	−113
4	104 05.5	263 23.2	02.2	281 33.4	16.4	18 42.7	48.2	253 49.8	56.3	262 55.4	149	14 17.3	−112
5	119 08.0	278 22.7	03.4	296 34.5	15.7	33 45.3	48.2	268 52.0	56.4	277 29.3	147	14 28.5	−112
6	134 10.5	293 22.3	− 7 04.6	311 35.5	+ 0 15.1	48 48.0	+22 48.2	283 54.2	− 9 56.5	292 03.0	148	− 14 39.7	−111
7	149 12.9	308 21.8	05.8	326 36.5	14.5	63 50.6	48.2	298 56.4	56.6	306 36.8	146	14 50.8	−110
8	164 15.4	323 21.4	07.0	341 37.6	13.9	78 53.3	48.2	313 58.5	56.7	321 10.4	146	15 01.8	−110
9	179 17.8	338 20.9	•• 08.1	356 38.6	•• 13.3	93 55.9	•• 48.2	329 00.7	•• 56.8	335 44.0	145	• 15 12.8	−110
10	194 20.3	353 20.5	09.3	11 39.7	12.7	108 58.6	48.1	344 02.9	56.9	350 17.5	145	15 23.8	−108
11	209 22.8	8 20.1	10.5	26 40.7	12.0	124 01.2	48.1	359 05.1	57.0	4 51.0	144	15 34.6	−108
12	224 25.2	23 19.6	− 7 11.7	41 41.7	+ 0 11.4	139 03.9	+22 48.1	14 07.3	− 9 57.1	19 24.4	144	− 15 45.4	−108
13	239 27.7	38 19.2	12.9	56 42.8	10.8	154 06.5	48.1	29 09.4	57.2	33 57.8	142	15 56.2	−107
14	254 30.2	53 18.7	14.0	71 43.8	10.2	169 09.2	48.1	44 11.6	57.3	48 31.0	142	16 06.9	−106
15	269 32.6	68 18.3	•• 15.2	86 44.9	•• 09.6	184 11.8	•• 48.1	59 13.8	•• 57.4	63 04.2	142	• 16 17.5	−106
16	284 35.1	83 17.8	16.4	101 45.9	09.0	199 14.5	48.1	74 16.0	57.5	77 37.4	141	16 28.1	−105
17	299 37.6	98 17.4	17.6	116 46.9	08.3	214 17.2	48.1	89 18.1	57.6	92 10.5	140	16 38.6	−104
18	314 40.0	113 16.9	− 7 18.7	131 48.0	+ 0 07.7	229 19.8	+22 48.1	104 20.3	− 9 57.7	106 43.5	139	− 16 49.0	−104
19	329 42.5	128 16.5	19.9	146 49.0	07.1	244 22.5	48.1	119 22.5	57.8	121 16.4	139	16 59.4	−103
20	344 45.0	143 16.0	21.1	161 50.1	06.5	259 25.1	48.1	134 24.7	57.9	135 49.3	138	17 09.7	−103
21	359 47.4	158 15.6	•• 22.3	176 51.1	•• 05.9	274 27.8	•• 48.1	149 26.9	•• 58.0	150 22.1	138	• 17 20.0	−101
22	14 49.9	173 15.1	23.4	191 52.2	05.3	289 30.4	48.1	164 29.0	58.1	164 54.9	136	17 30.1	−101
23	29 52.3	188 14.7	24.6	206 53.2	04.6	304 33.1	48.1	179 31.2	58.2	179 27.5	136	17 40.2	−101
24	44 54.8	203 14.2	− 7 25.8	221 54.2	+ 0 04.0	319 35.8	+22 48.1	194 33.4	− 9 58.3	194 00.1	136	−17 50.3	− 99
code	—	− 4	− 12	+ 10	− 6	+ 26	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
3 0	184 05.8	−14 54.3
1	199 05.8	55.1
2	214 05.8	55.9
3	229 05.8	56.7
4	244 05.8	57.5
5	259 05.8	58.3
6	274 05.8	−14 59.0
7	289 05.8	14 59.8
8	304 05.8	15 00.6
9	319 05.8	01.4
10	334 05.8	02.2
11	349 05.8	03.0
12	4 05.8	−15 03.7
13	19 05.8	04.5
14	34 05.8	05.3
15	49 05.8	06.1
16	64 05.8	06.9
17	79 05.8	07.6
18	94 05.8	−15 08.4
19	109 05.8	09.2
20	124 05.8	10.0
21	139 05.8	10.8
22	154 05.8	11.5
23	169 05.8	12.3
4 0	184 05.8	−15 13.1
1	199 05.8	13.9
2	214 05.7	14.6
3	229 05.7	15.4
4	244 05.7	16.2
5	259 05.7	17.0
6	274 05.7	−15 17.7
7	289 05.7	18.5
8	304 05.7	19.3
9	319 05.7	20.1
10	334 05.7	20.8
11	349 05.7	21.6
12	4 05.7	−15 22.4
13	19 05.7	23.2
14	34 05.6	23.9
15	49 05.6	24.7
16	64 05.6	25.5
17	79 05.6	26.2
18	94 05.6	−15 27.0
19	109 05.6	27.8
20	124 05.6	28.5
21	139 05.6	29.3
22	154 05.6	30.1
23	169 05.5	30.8
5 0	184 05.5	−15 31.6
1	199 05.5	32.4
2	214 05.5	33.1
3	229 05.5	33.9
4	244 05.5	34.7
5	259 05.4	35.4
6	274 05.4	−15 36.2
7	289 05.4	37.0
8	304 05.4	37.7
9	319 05.4	38.5
10	334 05.4	39.2
11	349 05.3	40.0
12	4 05.3	−15 40.8
13	19 05.3	41.5
14	34 05.3	42.3
15	49 05.3	43.0
16	64 05.3	43.8
17	79 05.2	44.6
18	94 05.2	−15 45.3
19	109 05.2	46.1
20	124 05.2	46.8
21	139 05.1	47.6
22	154 05.1	48.4
23	169 05.1	49.1
24	184 05.1	−15 49.9
code	—	- 8

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.7	−40 29.1
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.2	−62 50.5
19	Adhara	255 47.5	−28 54.2
10	Aldebaran	291 40.4	+16 25.3
32	Alioth	167 00.2	+56 12.4
34	Alkaid	153 34.4	+49 32.5
55	Al Na'ir	28 39.5	−47 11.2
15	Alnilam	276 31.5	− 1 13.6
25	Alphard	218 40.1	− 8 27.3
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.3
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.1	−68 57.0
22	Avior	234 36.4	−59 21.3
13	Bellatrix	279 19.7	+ 6 18.7
16	Betelg'se	271 49.5	+ 7 24.2
17	Canopus	264 15.7	−52 39.8
12	Capella	281 40.2	+45 57.2
53	Deneb	50 02.1	+45 07.2
28	Denebola	183 19.4	+14 49.8
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.5	+61 59.8
14	Elnath	279 08.9	+28 34.3
47	Eltanin	91 07.3	+51 29.8
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.5	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.3	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.8	+74 20.6
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.6	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.6	−56 53.3
21	Pollux	244 22.2	+28 08.3
20	Procyon	245 46.4	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.1	+12 11.6
11	Rigel	281 54.8	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.9
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.5
18	Sirius	259 12.9	−16 38.8
33	Spica	159 18.7	−10 55.2
23	Suhail	223 25.5	−43 14.4
49	Vega	81 09.5	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 3	4	5
h	m s	m s	m s
0	+16 23.1	+16 23.0	+16 22.1
6	+16 23.2	+16 22.9	+16 21.8
12	+16 23.2	+16 22.7	+16 21.3
18	+16 23.1	+16 22.4	+16 20.9
24	+16 23.0	+16 22.1	+16 20.4

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 3 h m	4 h m	5 h m	6 h m
72	9 15	4 56	4 07	6 04	8 23	■
70	8 45	4 59	4 00	5 47	7 46	10 38
68	8 23	5 00	3 54	5 33	7 20	9 25
66	8 05	5 02	3 50	5 23	7 01	8 49
64	7 51	5 02	3 46	5 14	6 45	8 23
62	7 39	5 03	3 43	5 06	6 33	8 03
60	7 29	5 04	3 40	4 59	6 22	7 47
58	7 21	5 03	3 37	4 54	6 12	7 33
56	7 13	5 04	3 35	4 49	6 04	7 21
54	7 06	5 03	3 33	4 44	5 57	7 11
52	7 00	5 03	3 31	4 40	5 50	7 02
50	6 54	5 03	3 29	4 36	5 44	6 54
45	6 42	5 01	3 26	4 28	5 32	6 37
40	6 32	4 59	3 23	4 21	5 22	6 23
35	6 24	4 57	3 20	4 16	5 13	6 11
30	6 16	4 54	3 18	4 11	5 05	6 01
20	6 03	4 47	3 14	4 02	4 52	5 43
10	5 51	4 39	3 10	3 55	4 40	5 28
0	5 40	4 29	3 07	3 48	4 30	5 14
10	5 29	4 16	3 04	3 41	4 19	5 00
20	5 17	4 00	3 01	3 33	4 08	4 45
30	5 03	3 37	2 57	3 25	3 55	4 28
35	4 55	3 22	2 55	3 20	3 47	4 18
40	4 46	3 03	2 52	3 15	3 39	4 07
45	4 35	2 38	2 50	3 09	3 29	3 54
50	4 22	2 03	2 46	3 01	3 18	3 38
52	4 16	1 43	2 45	2 58	3 12	3 30
54	4 09	1 18	2 43	2 54	3 06	3 22
56	4 01	0 34	2 42	2 50	3 00	3 13
58	3 52	////	2 40	2 45	2 52	3 02
60	3 43	////	2 37	2 40	2 44	2 50

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 3 h m	4 h m	5 h m	6 h m
72	14 11	18 26	13 59	13 27	12 37	■
70	14 41	18 24	14 08	13 46	13 15	11 57
68	15 03	18 22	14 16	14 01	13 42	13 11
66	15 21	18 22	14 23	14 13	14 03	13 48
64	15 35	18 21	14 28	14 24	14 20	14 15
62	15 47	18 21	14 33	14 33	14 33	14 36
60	15 57	18 21	14 37	14 40	14 45	14 53
58	16 06	18 21	14 41	14 47	14 55	15 07
56	16 14	18 22	14 44	14 53	15 04	15 19
54	16 21	18 22	14 47	14 58	15 12	15 30
52	16 27	18 22	14 50	15 03	15 19	15 40
50	16 32	18 22	14 52	15 08	15 26	15 48
45	16 45	18 25	14 58	15 17	15 40	16 06
40	16 55	18 27	15 03	15 26	15 51	16 21
35	17 03	18 29	15 06	15 33	16 01	16 34
30	17 11	18 32	15 10	15 39	16 10	16 45
20	17 24	18 39	15 16	15 49	16 25	17 04
10	17 36	18 48	15 21	15 59	16 38	17 21
0	17 47	18 58	15 26	16 07	16 51	17 37
10	17 58	19 11	15 32	16 16	17 03	17 52
20	18 10	19 28	15 37	16 26	17 16	18 09
30	18 24	19 51	15 43	16 37	17 32	18 29
35	18 33	20 07	15 47	16 43	17 41	18 40
40	18 42	20 26	15 51	16 50	17 51	18 53
45	18 53	20 52	15 56	16 59	18 03	19 09
50	19 06	21 27	16 01	17 09	18 18	19 28
52	19 13	21 49	16 04	17 13	18 25	19 37
54	19 20	22 17	16 07	17 19	18 32	19 47
56	19 27	23 04	16 10	17 24	18 41	19 59
58	19 36	////	16 14	17 31	18 51	20 12
60	19 46	////	16 18	17 38	19 02	20 28

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
3	9 17	10 25	9 17	2 54	11 11
4	9 58	10 26	9 15	2 50	11 07
5	10 40	10 27	9 13	2 45	11 04
6	11 25	10 27	9 12	2 41	11 00

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	3 ′	4 ′	5 ′
0	11.7	11.9	12.1
4	11.7	11.9	12.1
8	11.8	11.9	12.2
12	11.8	11.9	12.2
16	11.9	12.0	12.2
20	12.0	12.1	12.3
24	12.0	12.2	12.4
28	12.1	12.2	12.5
32	12.2	12.4	12.6
36	12.4	12.5	12.7
40	12.5	12.6	12.8
44	12.6	12.7	12.9
48	12.8	12.9	13.1
52	13.0	13.1	13.2
56	13.1	13.2	13.4
60	13.3	13.4	13.5
64	13.5	13.6	13.7
68	13.7	13.8	13.9
72	13.9	14.0	14.1
76	14.1	14.2	14.3
80	14.3	14.4	14.4
84	14.5	14.6	14.6
88	14.7	14.7	14.8
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	3 ′	4 ′	5 ′
0	17.7	17.7	17.5
4	17.7	17.6	17.5
8	17.7	17.6	17.5
12	17.6	17.6	17.4
16	17.6	17.5	17.4
20	17.5	17.5	17.3
24	17.4	17.4	17.2
28	17.3	17.3	17.2
32	17.2	17.2	17.1
36	17.1	17.0	16.9
40	17.0	16.9	16.8
44	16.8	16.8	16.7
48	16.7	16.6	16.6
52	16.5	16.5	16.4
56	16.3	16.3	16.2
60	16.1	16.1	16.1
64	16.0	15.9	15.9
68	15.8	15.8	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	14.9	15.0	15.0
88	14.8	14.8	14.9
90			

Subtract from table, back cover

Election Day (in certain States) 3

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
6 0	44 54.8	203 14.2	− 7 25.8	221 54.2	+ 0 04.0	319 35.8	+22 48.1	194 33.4	− 9 58.3	194 00.1	136	−17 50.3	− 99
1	59 57.3	218 13.8	27.0	236 55.3	03.4	334 38.4	48.1	209 35.6	58.4	208 32.7	134	18 00.2	− 99
2	74 59.7	233 13.3	28.1	251 56.3	02.8	349 41.1	48.1	224 37.8	58.5	223 05.1	134	18 10.1	− 98
3	90 02.2	248 12.9	•• 29.3	266 57.4	•• 02.2	4 43.7	•• 48.1	239 39.9	•• 58.6	237 37.5	133	•18 19.9	− 98
4	105 04.7	263 12.4	30.5	281 58.4	01.6	19 46.4	48.1	254 42.1	58.7	252 09.8	133	18 29.7	− 96
5	120 07.1	278 12.0	31.7	296 59.4	00.9	34 49.1	48.1	269 44.3	58.8	266 42.1	132	18 39.3	− 96
6	135 09.6	293 11.5	− 7 32.8	312 00.5	+ 0 00.3	49 51.7	+22 48.1	284 46.5	− 9 58.9	281 14.3	131	−18 48.9	− 95
7	150 12.1	308 11.1	34.0	327 01.5	− 0 00.3	64 54.4	48.1	299 48.6	59.0	295 46.4	130	18 58.4	− 95
8	165 14.5	323 10.6	35.2	342 02.6	00.9	79 57.0	48.1	314 50.8	59.1	310 18.4	130	19 07.9	− 93
9	180 17.0	338 10.2	•• 36.4	357 03.6	•• 01.5	94 59.7	•• 48.1	329 53.0	•• 59.2	324 50.4	129	•19 17.2	− 93
10	195 19.5	353 09.7	37.5	12 04.6	02.1	110 02.4	48.1	344 55.2	59.3	339 22.3	128	19 26.5	− 92
11	210 21.9	8 09.3	38.7	27 05.7	02.7	125 05.0	48.1	359 57.4	59.4	353 54.1	127	19 35.7	− 91
12	225 24.4	23 08.8	− 7 39.9	42 06.7	− 0 03.4	140 07.7	+22 48.0	14 59.5	− 9 59.5	8 25.8	127	−19 44.8	− 90
13	240 26.8	38 08.4	41.0	57 07.8	04.0	155 10.3	48.0	30 01.7	59.6	22 57.5	126	19 53.8	− 89
14	255 29.3	53 07.9	42.2	72 08.8	04.6	170 13.0	48.0	45 03.9	59.7	37 29.1	125	20 02.7	− 89
15	270 31.8	68 07.5	•• 43.4	87 09.9	•• 05.2	185 15.7	•• 48.0	60 06.1	•• 59.8	52 00.6	124	•20 11.6	− 88
16	285 34.2	83 07.0	44.6	102 10.9	05.8	200 18.3	48.0	75 08.3	9 59.9	66 32.0	124	20 20.4	− 86
17	300 36.7	98 06.6	45.7	117 11.9	06.4	215 21.0	48.0	90 10.4	10 00.0	81 03.4	123	20 29.0	− 86
18	315 39.2	113 06.1	− 7 46.9	132 13.0	− 0 07.1	230 23.7	+22 48.0	105 12.6	−10 00.1	95 34.7	122	−20 37.6	− 85
19	330 41.6	128 05.6	48.1	147 14.0	07.7	245 26.3	48.0	120 14.8	00.2	110 05.9	122	20 46.1	− 84
20	345 44.1	143 05.2	49.2	162 15.1	08.3	260 29.0	48.0	135 17.0	00.3	124 37.1	121	20 54.5	− 84
21	0 46.6	158 04.7	•• 50.4	177 16.1	•• 08.9	275 31.7	•• 48.0	150 19.2	•• 00.4	139 08.2	120	•21 02.9	− 82
22	15 49.0	173 04.3	51.6	192 17.1	09.5	290 34.3	48.0	165 21.3	00.5	153 39.2	119	21 11.1	− 81
23	30 51.5	188 03.8	52.8	207 18.2	10.1	305 37.0	48.0	180 23.5	00.6	168 10.1	118	21 19.2	− 81
7 0	45 54.0	203 03.4	− 7 53.9	222 19.2	− 0 10.8	320 39.7	+22 48.0	195 25.7	−10 00.7	182 40.9	118	−21 27.3	− 79
1	60 56.4	218 02.9	55.1	237 20.3	11.4	335 42.3	48.0	210 27.9	00.8	197 11.7	117	21 35.2	− 79
2	75 58.9	233 02.5	56.3	252 21.3	12.0	350 45.0	48.0	225 30.1	00.9	211 42.4	116	21 43.1	− 77
3	91 01.3	248 02.0	•• 57.4	267 22.4	•• 12.6	5 47.7	•• 48.0	240 32.2	•• 01.0	226 13.0	116	•21 50.8	− 77
4	106 03.8	263 01.5	58.6	282 23.4	13.2	20 50.3	48.0	255 34.4	01.1	240 43.6	115	21 58.5	− 75
5	121 06.3	278 01.1	7 59.8	297 24.4	13.8	35 53.0	48.0	270 36.6	01.2	255 14.1	114	22 06.0	− 75
6	136 08.7	293 00.6	− 8 00.9	312 25.5	− 0 14.5	50 55.7	+22 48.0	285 38.8	−10 01.3	269 44.5	113	−22 13.5	− 73
7	151 11.2	308 00.2	02.1	327 26.5	15.1	65 58.3	48.0	300 40.9	01.4	284 14.8	113	22 20.8	− 73
8	166 13.7	322 59.7	03.3	342 27.6	15.7	81 01.0	48.0	315 43.1	01.5	298 45.1	112	22 28.1	− 71
9	181 16.1	337 59.2	•• 04.4	357 28.6	•• 16.3	96 03.7	•• 48.0	330 45.3	•• 01.6	313 15.3	111	•22 35.2	− 70
10	196 18.6	352 58.8	05.6	12 29.6	16.9	111 06.3	48.0	345 47.5	01.7	327 45.4	110	22 42.2	− 70
11	211 21.1	7 58.3	06.8	27 30.7	17.5	126 09.0	48.0	0 49.7	01.8	342 15.4	110	22 49.2	− 68
12	226 23.5	22 57.9	− 8 07.9	42 31.7	− 0 18.1	141 11.7	+22 47.9	15 51.8	−10 01.9	356 45.4	109	−22 56.0	− 67
13	241 26.0	37 57.4	09.1	57 32.8	18.8	156 14.3	47.9	30 54.0	02.0	11 15.3	108	23 02.7	− 66
14	256 28.4	52 56.9	10.3	72 33.8	19.4	171 17.0	47.9	45 56.2	02.1	25 45.1	107	23 09.3	− 65
15	271 30.9	67 56.5	•• 11.4	87 34.9	•• 20.0	186 19.7	•• 47.9	60 58.4	•• 02.2	40 14.8	107	•23 15.8	− 64
16	286 33.4	82 56.0	12.6	102 35.9	20.6	201 22.4	47.9	76 00.6	02.3	54 44.5	106	23 22.2	− 63
17	301 35.8	97 55.6	13.7	117 36.9	21.2	216 25.0	47.9	91 02.7	02.4	69 14.1	106	23 28.5	− 62
18	316 38.3	112 55.1	− 8 14.9	132 38.0	− 0 21.8	231 27.7	+22 47.9	106 04.9	−10 02.5	83 43.7	104	−23 34.7	− 60
19	331 40.8	127 54.6	16.1	147 39.0	22.5	246 30.4	47.9	121 07.1	02.6	98 13.1	104	23 40.7	− 60
20	346 43.2	142 54.2	17.2	162 40.1	23.1	261 33.0	47.9	136 09.3	02.7	112 42.5	104	23 46.7	− 58
21	1 45.7	157 53.7	•• 18.4	177 41.1	•• 23.7	276 35.7	•• 47.9	151 11.5	•• 02.8	127 11.9	102	•23 52.5	− 57
22	16 48.2	172 53.3	19.6	192 42.1	24.3	291 38.4	47.9	166 13.6	02.9	141 41.1	102	23 58.2	− 56
23	31 50.6	187 52.8	20.7	207 43.2	24.9	306 41.1	47.9	181 15.8	03.0	156 10.3	102	24 03.8	− 55
8 0	46 53.1	202 52.3	− 8 21.9	222 44.2	− 0 25.5	321 43.7	+22 47.9	196 18.0	−10 03.1	170 39.5	100	−24 09.3	− 54
1	61 55.6	217 51.9	23.0	237 45.3	26.2	336 46.4	47.9	211 20.2	03.2	185 08.5	100	24 14.7	− 52
2	76 58.0	232 51.4	24.2	252 46.3	26.8	351 49.1	47.9	226 22.4	03.3	199 37.5	100	24 19.9	− 51
3	92 00.5	247 50.9	•• 25.4	267 47.4	•• 27.4	6 51.8	•• 47.9	241 24.5	•• 03.4	214 06.5	98	•24 25.0	− 50
4	107 02.9	262 50.5	26.5	282 48.4	28.0	21 54.4	47.9	256 26.7	03.5	228 35.3	98	24 30.0	− 49
5	122 05.4	277 50.0	27.7	297 49.4	28.6	36 57.1	47.9	271 28.9	03.6	243 04.1	98	24 34.9	− 48
6	137 07.9	292 49.5	− 8 28.8	312 50.5	− 0 29.2	51 59.8	+22 47.9	286 31.1	−10 03.7	257 32.9	97	−24 39.7	− 46
7	152 10.3	307 49.1	30.0	327 51.5	29.8	67 02.5	47.9	301 33.3	03.8	272 01.6	96	24 44.3	− 45
8	167 12.8	322 48.6	31.2	342 52.6	30.5	82 05.1	47.9	316 35.4	03.9	286 30.2	95	24 48.8	− 44
9	182 15.3	337 48.1	•• 32.3	357 53.6	•• 31.1	97 07.8	•• 47.9	331 37.6	•• 04.0	300 58.7	96	•24 53.2	− 43
10	197 17.7	352 47.7	33.5	12 54.7	31.7	112 10.5	47.9	346 39.8	04.1	315 27.3	94	24 57.5	− 41
11	212 20.2	7 47.2	34.6	27 55.7	32.3	127 13.2	47.8	1 42.0	04.2	329 55.7	94	25 01.6	− 40
12	227 22.7	22 46.7	− 8 35.8	42 56.7	− 0 32.9	142 15.9	+22 47.8	16 44.2	−10 04.4	344 24.1	93	−25 05.6	− 39
13	242 25.1	37 46.3	37.0	57 57.8	33.5	157 18.5	47.8	31 46.3	04.5	358 52.4	93	25 09.5	− 37
14	257 27.6	52 45.8	38.1	72 58.8	34.1	172 21.2	47.8	46 48.5	04.6	13 20.7	92	25 13.2	− 36
15	272 30.1	67 45.3	•• 39.3	87 59.9	•• 34.8	187 23.9	•• 47.8	61 50.7	•• 04.7	27 48.9	92	•25 16.8	− 35
16	287 32.5	82 44.9	40.4	103 00.9	35.4	202 26.6	47.8	76 52.9	04.8	42 17.1	91	25 20.3	− 34
17	302 35.0	97 44.4	41.6	118 01.9	36.0	217 29.3	47.8	91 55.1	04.9	56 45.2	90	25 23.7	− 32
18	317 37.4	112 43.9	− 8 42.7	133 03.0	− 0 36.6	232 31.9	+22 47.8	106 57.2	−10 05.0	71 13.2	90	−25 26.9	− 31
19	332 39.9	127 43.4	43.9	148 04.0	37.2	247 34.6	47.8	121 59.4	05.0	85 41.2	90	25 30.0	− 30
20	347 42.4	142 43.0	45.1	163 05.1	37.8	262 37.3	47.8	137 01.6	05.1	100 09.2	89	25 33.0	− 28
21	2 44.8	157 42.5	•• 46.2	178 06.1	•• 38.5	277 40.0	•• 47.8	152 03.8	•• 05.2	114 37.1	89	•25 35.8	− 27
22	17 47.3	172 42.0	47.4	193 07.2	39.1	292 42.7	47.8	167 06.0	05.3	129 05.0	88	25 38.5	− 25
23	32 49.8	187 41.6	48.5	208 08.2	39.7	307 45.3	47.8	182 08.1	05.4	143 32.8	88	25 41.0	− 25
24	47 52.2	202 41.1	− 8 49.7	223 09.2	− 0 40.3	322 48.0	+22 47.8	197 10.3	−10 05.5	158 00.6	87	−25 43.5	− 23
code	—	− 5	− 12	+ 11	− 7	+ 26	0	+ 22	− 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
6	0	184 05.1	−15 49.9
	1	199 05.1	50.6
	2	214 05.0	51.4
	3	229 05.0	52.1
	4	244 05.0	52.9
	5	259 05.0	53.6
	6	274 04.9	−15 54.4
	7	289 04.9	55.1
	8	304 04.9	55.9
	9	319 04.9	56.6
	10	334 04.8	57.4
	11	349 04.8	58.1
	12	4 04.8	−15 58.9
	13	19 04.8	15 59.6
	14	34 04.7	16 00.4
	15	49 04.7	01.1
	16	64 04.7	01.9
	17	79 04.6	02.6
	18	94 04.6	−16 03.4
	19	109 04.6	04.1
	20	124 04.6	04.9
	21	139 04.5	05.6
	22	154 04.5	06.4
	23	169 04.5	07.1
7	0	184 04.4	−16 07.9
	1	199 04.4	08.6
	2	214 04.4	09.3
	3	229 04.3	10.1
	4	244 04.3	10.8
	5	259 04.3	11.6
	6	274 04.2	−16 12.3
	7	289 04.2	13.1
	8	304 04.2	13.8
	9	319 04.1	14.5
	10	334 04.1	15.3
	11	349 04.1	16.0
	12	4 04.0	−16 16.8
	13	19 04.0	17.5
	14	34 03.9	18.2
	15	49 03.9	19.0
	16	64 03.9	19.7
	17	79 03.8	20.4
	18	94 03.8	−16 21.2
	19	109 03.8	21.9
	20	124 03.7	22.6
	21	139 03.7	23.4
	22	154 03.6	24.1
	23	169 03.6	24.8
8	0	184 03.6	−16 25.6
	1	199 03.5	26.3
	2	214 03.5	27.0
	3	229 03.4	27.8
	4	244 03.4	28.5
	5	259 03.4	29.2
	6	274 03.3	−16 30.0
	7	289 03.3	30.7
	8	304 03.2	31.4
	9	319 03.2	32.2
	10	334 03.1	32.9
	11	349 03.1	33.6
	12	4 03.1	−16 34.3
	13	19 03.0	35.1
	14	34 03.0	35.8
	15	49 02.9	36.5
	16	64 02.9	37.2
	17	79 02.8	38.0
	18	94 02.8	−16 38.7
	19	109 02.7	39.4
	20	124 02.7	40.1
	21	139 02.6	40.9
	22	154 02.6	41.6
	23	169 02.5	42.3
	24	184 02.5	−16 43.0
	code	—	- 7

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.1
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.2	−62 50.5
19	Adhara	255 47.5	−28 54.2
10	Aldebaran	291 40.4	+16 25.3
32	Alioth	167 00.2	+56 12.4
34	Alkaid	153 34.4	+49 32.4
55	Al Na'ir	28 39.6	−47 11.2
15	Alnilam	276 31.5	− 1 13.6
25	Alphard	218 40.0	− 8 27.3
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.3	−59 21.3
13	Bellatrix	279 19.7	+ 6 18.7
16	Betelg'se	271 49.4	+ 7 24.2
17	Canopus	264 15.7	−52 39.9
12	Capella	281 40.2	+45 57.2
53	Deneb	50 02.1	+45 07.2
28	Denebola	183 19.4	+14 49.7
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.5	+61 59.8
14	Elnath	279 08.9	+28 34.3
47	Eltanin	91 07.3	+51 29.8
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.5	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.2	−60 09.1
6	Hamal	328 51.0	+23 14.9
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.5
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.6	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.6	−56 53.3
21	Pollux	244 22.2	+28 08.3
20	Procyon	245 46.4	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.1	+12 11.6
11	Rigel	281 54.7	− 8 15.0
38	Rigil Kent.	140 53.8	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.9	−16 38.9
33	Spica	159 18.7	−10 55.2
23	Suhail	223 25.5	−43 14.4
49	Vega	81 09.5	+38 44.6
39	Zub'g'bl	137 55.3	−15 51.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 6 h m	7 h m	8 h m	9 h m
72	9 36	5 07	▬	▬	▬	▬
70	9 01	5 08	10 38	▬	▬	▬
68	8 36	5 09	9 25	▬	▬	▬
66	8 16	5 10	8 49	10 58	▬	▬
64	8 01	5 10	8 23	10 08	12 01	▬
62	7 48	5 10	8 03	9 37	11 09	12 24
60	7 37	5 10	7 47	9 13	10 37	11 46
58	7 28	5 09	7 33	8 55	10 13	11 20
56	7 19	5 09	7 21	8 39	9 54	10 59
54	7 12	5 08	7 11	8 26	9 38	10 41
52	7 05	5 08	7 02	8 14	9 24	10 26
50	6 59	5 07	6 54	8 04	9 12	10 13
45	6 46	5 05	6 37	7 43	8 47	9 47
40	6 36	5 03	6 23	7 25	8 27	9 26
35	6 26	5 00	6 11	7 11	8 11	9 08
30	6 18	4 56	6 01	6 58	7 56	8 53
20	6 04	4 49	5 43	6 37	7 32	8 28
10	5 52	4 40	5 28	6 19	7 11	8 06
0	5 40	4 28	5 14	6 02	6 52	7 45
10	5 29	4 15	5 00	5 44	6 33	7 25
20	5 16	3 58	4 45	5 26	6 12	7 03
30	5 01	3 34	4 28	5 05	5 49	6 38
35	4 53	3 18	4 18	4 53	5 35	6 23
40	4 43	2 59	4 07	4 39	5 19	6 06
45	4 31	2 32	3 54	4 23	5 00	5 45
50	4 17	1 55	3 38	4 03	4 36	5 19
52	4 10	1 32	3 30	3 53	4 24	5 06
54	4 03	1 01	3 22	3 43	4 12	4 52
56	3 55	////	3 13	3 31	3 57	4 35
58	3 46	////	3 02	3 17	3 39	4 15
60 S	3 35	////	2 50	3 00	3 18	3 50

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 6 h m	7 h m	8 h m	9 h m
72	13 50	18 15	▬	▬	▬	▬
70	14 26	18 15	11 57	▬	▬	▬
68	14 51	18 14	13 11	▬	▬	▬
66	15 10	18 14	13 48	13 19	▬	▬
64	15 26	18 15	14 15	14 10	14 03	▬
62	15 39	18 15	14 36	14 41	14 56	15 32
60	15 50	18 15	14 53	15 05	15 28	16 10
58	15 59	18 15	15 07	15 24	15 52	16 37
56	16 07	18 16	15 19	15 40	16 12	16 58
54	16 15	18 17	15 30	15 54	16 28	17 15
52	16 22	18 18	15 40	16 06	16 42	17 30
50	16 28	18 19	15 48	16 17	16 54	17 43
45	16 41	18 21	16 06	16 39	17 19	18 10
40	16 51	18 23	16 21	16 57	17 40	18 31
35	17 01	18 27	16 34	17 12	17 57	18 48
30	17 09	18 31	16 45	17 25	18 11	19 03
20	17 23	18 38	17 04	17 48	18 36	19 29
10	17 35	18 47	17 21	18 07	18 57	19 51
0	17 47	18 59	17 37	18 26	19 17	20 11
10	17 59	19 13	17 52	18 44	19 37	20 32
20	18 12	19 31	18 09	19 03	19 59	20 54
30	18 27	19 55	18 29	19 26	20 24	21 19
35	18 36	20 11	18 40	19 40	20 38	21 34
40	18 45	20 31	18 53	19 55	20 55	21 52
45	18 57	20 58	19 09	20 14	21 16	22 12
50	19 11	21 37	19 28	20 37	21 42	22 38
52	19 18	22 00	19 37	20 48	21 54	22 51
54	19 26	22 34	19 47	21 00	22 08	23 06
56	19 34	////	19 59	21 15	22 25	23 23
58	19 43	////	20 12	21 32	22 45	23 43
60 S	19 54	////	20 28	21 53	23 10	24 09

GMT h	Equation of Time (App.—Mean) 6 m s	7 m s	8 m s
0	+16 20.4	+16 17.8	+16 14.3
6	+16 19.8	+16 17.0	+16 13.3
12	+16 19.2	+16 16.2	+16 12.3
18	+16 18.5	+16 15.3	+16 11.2
24	+16 17.8	+16 14.3	+16 10.1

GMT of Transit Meridian of Greenwich DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
6	11 25	10 27	9 12	2 41	11 00
7	12 13	10 28	9 10	2 37	10 57
8	13 05	10 29	9 08	2 33	10 53
9	13 58	10 30	9 07	2 28	10 50

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	6 ′	7 ′	8 ′
0	12.5	13.0	13.5
4	12.5	13.0	13.5
8	12.5	13.0	13.5
12	12.6	13.1	13.6
16	12.6	13.1	13.6
20	12.7	13.2	13.6
24	12.7	13.2	13.7
28	12.8	13.3	13.7
32	12.9	13.3	13.8
36	13.0	13.4	13.9
40	13.1	13.5	13.9
44	13.2	13.6	14.0
48	13.4	13.7	14.1
52	13.5	13.8	14.2
56	13.6	13.9	14.3
60	13.8	14.1	14.4
64	13.9	14.2	14.5
68	14.1	14.3	14.6
72	14.2	14.5	14.7
76	14.4	14.6	14.8
80	14.6	14.7	14.9
84	14.7	14.9	15.0
88	14.9	15.0	15.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	6 ′	7 ′	8 ′
0	17.3	17.0	16.7
4	17.3	17.0	16.7
8	17.3	17.0	16.7
12	17.2	16.9	16.7
16	17.2	16.9	16.6
20	17.1	16.9	16.6
24	17.1	16.8	16.6
28	17.0	16.7	16.5
32	16.9	16.7	16.4
36	16.8	16.6	16.4
40	16.7	16.5	16.3
44	16.6	16.4	16.2
48	16.4	16.3	16.1
52	16.3	16.2	16.1
56	16.2	16.1	16.0
60	16.0	15.9	15.9
64	15.9	15.8	15.8
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.3	15.3
84	15.1	15.1	15.2
88	14.9	15.0	15.1
90			

Subtract from table, back cover

New Moon 6

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
9 0	47 52.2	202 41.1	− 8 49.7	223 09.2	− 0 40.3	322 48.0	+22 47.8	197 10.3	−10 05.5	158 00.6	87	−25 43.5	− 23
1	62 54.7	217 40.6	50.8	238 10.3	40.9	337 50.7	47.8	212 12.5	05.6	172 28.3	87	25 45.8	− 21
2	77 57.2	232 40.2	52.0	253 11.3	41.5	352 53.4	47.8	227 14.7	05.7	186 56.0	86	25 47.9	− 20
3	92 59.6	247 39.7	•• 53.1	268 12.4	•• 42.1	7 56.1	•• 47.8	242 16.9	•• 05.8	201 23.6	86	•25 49.9	− 19
4	108 02.1	262 39.2	54.3	283 13.4	42.8	22 58.7	47.8	257 19.0	05.9	215 51.2	86	25 51.8	− 17
5	123 04.5	277 38.7	55.4	298 14.5	43.4	38 01.4	47.8	272 21.2	06.0	230 18.8	85	25 53.5	− 16
6	138 07.0	292 38.3	− 8 56.6	313 15.5	− 0 44.0	53 04.1	+22 47.8	287 23.4	−10 06.1	244 46.3	85	−25 55.1	− 15
7	153 09.5	307 37.8	57.7	328 16.5	44.6	68 06.8	47.8	302 25.6	06.2	259 13.8	84	25 56.6	− 13
8	168 11.9	322 37.3	8 58.9	343 17.6	45.2	83 09.5	47.7	317 27.8	06.3	273 41.2	85	25 57.9	− 12
9	183 14.4	337 36.8	• 9 00.0	358 18.6	•• 45.8	98 12.2	•• 47.7	332 29.9	•• 06.4	288 08.7	83	•25 59.1	− 10
10	198 16.9	352 36.4	01.2	13 19.7	46.4	113 14.9	47.7	347 32.1	06.5	302 36.0	84	26 00.1	− 9
11	213 19.3	7 35.9	02.3	28 20.7	47.1	128 17.5	47.7	2 34.3	06.6	317 03.4	83	26 01.0	− 8
12	228 21.8	22 35.4	− 9 03.5	43 21.8	− 0 47.7	143 20.2	+22 47.7	17 36.5	−10 06.7	331 30.7	83	−26 01.8	− 6
13	243 24.3	37 34.9	04.6	58 22.8	48.3	158 22.9	47.7	32 38.7	06.8	345 58.0	83	26 02.4	− 5
14	258 26.7	52 34.5	05.8	73 23.8	48.9	173 25.6	47.7	47 40.8	06.9	0 25.3	82	26 02.9	− 3
15	273 29.2	67 34.0	•• 06.9	88 24.9	•• 49.5	188 28.3	•• 47.7	62 43.0	•• 07.0	14 52.5	82	•26 03.2	− 2
16	288 31.7	82 33.5	08.1	103 25.9	50.1	203 31.0	47.7	77 45.2	07.1	29 19.7	82	26 03.4	0
17	303 34.1	97 33.0	09.2	118 27.0	50.7	218 33.7	47.7	92 47.4	07.2	43 46.9	82	26 03.4	+ 1
18	318 36.6	112 32.5	− 9 10.4	133 28.0	− 0 51.4	233 36.4	+22 47.7	107 49.6	−10 07.3	58 14.1	81	−26 03.3	+ 2
19	333 39.0	127 32.1	11.5	148 29.1	52.0	248 39.0	47.7	122 51.7	07.4	72 41.2	82	26 03.1	+ 4
20	348 41.5	142 31.6	12.7	163 30.1	52.6	263 41.7	47.7	137 53.9	07.5	87 08.4	81	26 02.7	+ 5
21	3 44.0	157 31.1	•• 13.8	178 31.1	•• 53.2	278 44.4	•• 47.7	152 56.1	•• 07.6	101 35.5	81	•26 02.2	+ 7
22	18 46.4	172 30.6	15.0	193 32.2	53.8	293 47.1	47.7	167 58.3	07.7	116 02.6	80	26 01.5	+ 8
23	33 48.9	187 30.2	16.1	208 33.2	54.4	308 49.8	47.7	183 00.5	07.8	130 29.6	81	26 00.7	+ 10
10 0	48 51.4	202 29.7	− 9 17.3	223 34.3	− 0 55.0	323 52.5	+22 47.7	198 02.7	−10 07.9	144 56.7	80	−25 59.7	+ 11
1	63 53.8	217 29.2	18.4	238 35.3	55.7	338 55.2	47.7	213 04.8	08.0	159 23.7	81	25 58.6	+ 13
2	78 56.3	232 28.7	19.6	253 36.4	56.3	353 57.9	47.7	228 07.0	08.1	173 50.8	80	25 57.3	+ 14
3	93 58.8	247 28.2	•• 20.7	268 37.4	•• 56.9	9 00.6	•• 47.7	243 09.2	•• 08.2	188 17.8	80	•25 55.9	+ 15
4	109 01.2	262 27.8	21.9	283 38.4	57.5	24 03.2	47.7	258 11.4	08.3	202 44.8	80	25 54.4	+ 17
5	124 03.7	277 27.3	23.0	298 39.5	58.1	39 05.9	47.6	273 13.6	08.4	217 11.8	80	25 52.7	+ 18
6	139 06.2	292 26.8	− 9 24.1	313 40.5	− 0 58.7	54 08.6	+22 47.6	288 15.7	−10 08.5	231 38.8	81	−25 50.9	+ 20
7	154 08.6	307 26.3	25.3	328 41.6	0 59.3	69 11.3	47.6	303 17.9	08.6	246 05.9	79	25 48.9	+ 21
8	169 11.1	322 25.8	26.4	343 42.6	1 00.0	84 14.0	47.6	318 20.1	08.7	260 32.8	80	25 46.8	+ 23
9	184 13.5	337 25.3	•• 27.6	358 43.7	•• 00.6	99 16.7	•• 47.6	333 22.3	•• 08.8	274 59.8	80	•25 44.5	+ 24
10	199 16.0	352 24.9	28.7	13 44.7	01.2	114 19.4	47.6	348 24.5	08.9	289 26.8	80	25 42.1	+ 26
11	214 18.5	7 24.4	29.9	28 45.7	01.8	129 22.1	47.6	3 26.6	09.0	303 53.8	80	25 39.5	+ 27
12	229 20.9	22 23.9	− 9 31.0	43 46.8	− 1 02.4	144 24.8	+22 47.6	18 28.8	−10 09.1	318 20.8	80	−25 36.8	+ 28
13	244 23.4	37 23.4	32.1	58 47.8	03.0	159 27.5	47.6	33 31.0	09.2	332 47.8	80	25 34.0	+ 30
14	259 25.9	52 22.9	33.3	73 48.9	03.6	174 30.2	47.6	48 33.2	09.3	347 14.8	80	25 31.0	+ 31
15	274 28.3	67 22.4	•• 34.4	88 49.9	•• 04.3	189 32.9	•• 47.6	63 35.4	•• 09.4	1 41.8	81	•25 27.9	+ 33
16	289 30.8	82 22.0	35.6	103 51.0	04.9	204 35.6	47.6	78 37.5	09.5	16 08.9	80	25 24.6	+ 35
17	304 33.3	97 21.5	36.7	118 52.0	05.5	219 38.3	47.6	93 39.7	09.6	30 35.9	80	25 21.1	+ 35
18	319 35.7	112 21.0	− 9 37.8	133 53.1	− 1 06.1	234 41.0	+22 47.6	108 41.9	−10 09.7	45 02.9	81	−25 17.6	+ 37
19	334 38.2	127 20.5	39.0	148 54.1	06.7	249 43.7	47.6	123 44.1	09.8	59 30.0	80	25 13.9	+ 39
20	349 40.7	142 20.0	40.1	163 55.1	07.3	264 46.3	47.6	138 46.3	09.9	73 57.0	81	25 10.0	+ 40
21	4 43.1	157 19.5	•• 41.3	178 56.2	•• 07.9	279 49.0	•• 47.6	153 48.5	•• 10.0	88 24.1	81	•25 06.0	+ 41
22	19 45.6	172 19.0	42.4	193 57.2	08.5	294 51.7	47.6	168 50.6	10.1	102 51.2	81	25 01.9	+ 43
23	34 48.0	187 18.5	43.5	208 58.3	09.2	309 54.4	47.6	183 52.8	10.2	117 18.3	81	24 57.6	+ 45
11 0	49 50.5	202 18.1	− 9 44.7	223 59.3	− 1 09.8	324 57.1	+22 47.6	198 55.0	−10 10.3	131 45.4	81	−24 53.1	+ 45
1	64 53.0	217 17.6	45.8	239 00.4	10.4	339 59.8	47.5	213 57.2	10.4	146 12.5	82	24 48.6	+ 48
2	79 55.4	232 17.1	46.9	254 01.4	11.0	355 02.5	47.5	228 59.4	10.5	160 39.7	82	24 43.8	+ 48
3	94 57.9	247 16.6	•• 48.1	269 02.4	•• 11.6	10 05.2	•• 47.5	244 01.5	•• 10.6	175 06.9	82	•24 39.0	+ 50
4	110 00.4	262 16.1	49.2	284 03.5	12.2	25 07.9	47.5	259 03.7	10.7	189 34.1	82	24 34.0	+ 51
5	125 02.8	277 15.6	50.4	299 04.5	12.8	40 10.6	47.5	274 05.9	10.8	204 01.3	82	24 28.9	+ 53
6	140 05.3	292 15.1	− 9 51.5	314 05.6	− 1 13.4	55 13.3	+22 47.5	289 08.1	−10 10.9	218 28.5	83	−24 23.6	+ 54
7	155 07.8	307 14.6	52.6	329 06.6	14.1	70 16.0	47.5	304 10.3	11.0	232 55.8	83	24 18.2	+ 56
8	170 10.2	322 14.1	53.8	344 07.7	14.7	85 18.7	47.5	319 12.5	11.1	247 23.1	83	24 12.6	+ 57
9	185 12.7	337 13.6	•• 54.9	359 08.7	•• 15.3	100 21.4	•• 47.5	334 14.6	•• 11.2	261 50.4	83	•24 06.9	+ 58
10	200 15.1	352 13.2	56.0	14 09.7	15.9	115 24.1	47.5	349 16.8	11.3	276 17.7	84	24 01.1	+ 60
11	215 17.6	7 12.7	57.2	29 10.8	16.5	130 26.8	47.5	4 19.0	11.4	290 45.1	84	23 55.1	+ 61
12	230 20.1	22 12.2	− 9 58.3	44 11.8	− 1 17.1	145 29.5	+22 47.5	19 21.2	−10 11.5	305 12.5	84	−23 49.0	+ 63
13	245 22.5	37 11.7	9 59.4	59 12.9	17.7	160 32.2	47.5	34 23.4	11.6	319 39.9	85	23 42.7	+ 63
14	260 25.0	52 11.2	10 00.6	74 13.9	18.4	175 34.9	47.5	49 25.5	11.7	334 07.4	85	23 36.4	+ 66
15	275 27.5	67 10.7	•• 01.7	89 15.0	•• 19.0	190 37.6	•• 47.5	64 27.7	•• 11.8	348 34.9	85	•23 29.8	+ 66
16	290 29.9	82 10.2	02.8	104 16.0	19.6	205 40.3	47.5	79 29.9	11.9	3 02.4	85	23 23.2	+ 68
17	305 32.4	97 09.7	04.0	119 17.1	20.2	220 43.0	47.5	94 32.1	12.0	17 29.9	86	23 16.4	+ 69
18	320 34.9	112 09.2	−10 05.1	134 18.1	− 1 20.8	235 45.7	+22 47.5	109 34.3	−10 12.1	31 57.5	86	−23 09.5	+ 71
19	335 37.3	127 08.7	06.2	149 19.1	21.4	250 48.4	47.4	124 36.5	12.2	46 25.1	87	23 02.4	+ 72
20	350 39.8	142 08.2	07.3	164 20.2	22.0	265 51.2	47.4	139 38.6	12.3	60 52.8	87	22 55.2	+ 73
21	5 42.3	157 07.7	•• 08.5	179 21.2	•• 22.6	280 53.9	•• 47.4	154 40.8	•• 12.4	75 20.5	87	•22 47.9	+ 74
22	20 44.7	172 07.2	09.6	194 22.3	23.3	295 56.6	47.4	169 43.0	12.5	89 48.2	88	22 40.5	+ 76
23	35 47.2	187 06.7	10.7	209 23.3	23.9	310 59.3	47.4	184 45.2	12.6	104 16.0	87	22 32.9	+ 77
24	50 49.6	202 06.2	−10 11.9	224 24.4	− 1 24.5	326 02.0	+22 47.4	199 47.4	−10 12.7	118 43.7	89	−22 25.2	+ 79
code	−	− 5	− 11	+ 10	− 6	+ 27	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
9 0	184 02.5	−16 43.0
1	199 02.4	43.8
2	214 02.4	44.5
3	229 02.3	45.2
4	244 02.3	45.9
5	259 02.2	46.6
6	274 02.2	−16 47.3
7	289 02.1	48.1
8	304 02.1	48.8
9	319 02.0	49.5
10	334 02.0	50.2
11	349 01.9	50.9
12	4 01.9	−16 51.7
13	19 01.8	52.4
14	34 01.8	53.1
15	49 01.7	53.8
16	64 01.7	54.5
17	79 01.6	55.2
18	94 01.6	−16 55.9
19	109 01.5	56.6
20	124 01.4	57.4
21	139 01.4	58.1
22	154 01.3	58.8
23	169 01.3	16 59.5
10 0	184 01.2	−17 00.2
1	199 01.1	00.9
2	214 01.1	01.6
3	229 01.0	02.3
4	244 01.0	03.0
5	259 00.9	03.7
6	274 00.9	−17 04.4
7	289 00.8	05.1
8	304 00.7	05.9
9	319 00.7	06.6
10	334 00.6	07.3
11	349 00.6	08.0
12	4 00.5	−17 08.7
13	19 00.4	09.4
14	34 00.4	10.1
15	49 00.3	10.8
16	64 00.2	11.5
17	79 00.2	12.2
18	94 00.1	−17 12.9
19	109 00.0	13.6
20	124 00.0	14.3
21	138 59.9	15.0
22	153 59.9	15.7
23	168 59.8	16.4
11 0	183 59.7	−17 17.1
1	198 59.6	17.8
2	213 59.6	18.5
3	228 59.5	19.2
4	243 59.4	19.9
5	258 59.4	20.5
6	273 59.3	−17 21.2
7	288 59.2	21.9
8	303 59.2	22.6
9	318 59.1	23.3
10	333 59.0	24.0
11	348 59.0	24.7
12	3 58.9	−17 25.4
13	18 58.8	26.1
14	33 58.8	26.8
15	48 58.7	27.5
16	63 58.6	28.2
17	78 58.5	28.8
18	93 58.5	−17 29.5
19	108 58.4	30.2
20	123 58.3	30.9
21	138 58.2	31.6
22	153 58.2	32.3
23	168 58.1	33.0
24	183 58.0	−17 33.6
code	—	− 7

No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.1	−62 50.5
19	Adhara	255 47.5	−28 54.2
10	Aldebaran	291 40.4	+16 25.2
32	Alioth	167 00.1	+56 12.4
34	Alkaid	153 34.4	+49 32.4
55	Al Na'ir	28 39.6	−47 11.3
15	Alnilam	276 31.5	− 1 13.6
25	Alphard	218 40.0	− 8 27.3
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.3
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.3	−59 21.3
13	Bellatrix	279 19.7	+ 6 18.7
16	Betelg'se	271 49.4	+ 7 24.1
17	Canopus	264 15.6	−52 39.9
12	Capella	281 40.2	+45 57.2
53	Deneb	50 02.1	+45 07.2
28	Denebola	183 19.4	+14 49.7
4	Diphda	349 40.4	−18 14.2
27	Dubhe	194 46.5	+61 59.7
14	Elnath	279 08.8	+28 34.3
47	Eltanin	91 07.3	+51 29.8
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.4	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.2	−60 09.1
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.5
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.5	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.6	−56 53.3
21	Pollux	244 22.2	+28 08.3
20	Procyon	245 46.3	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.1	+12 11.6
11	Rigel	281 54.7	− 8 15.0
38	Rigil Kent.	140 53.7	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.9	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.4	−43 14.4
49	Vega	81 09.5	+38 44.6
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 9	10	11
h	m s	m s	m s
0	+16 10.1	+16 05.0	+15 59.0
6	+16 08.9	+16 03.5	+15 57.4
12	+16 07.6	+16 02.1	+15 55.7
18	+16 06.3	+16 00.6	+15 54.0
24	+16 05.0	+15 59.0	+15 52.2

Lat.	Sunrise	Twlt. begins	Moonrise 9	10	11	12
N °	h m	h m	h m	h m	h m	h m
72	10 01	5 18	—	—	—	—
70	9 17	5 18	—	—	—	—
68	8 49	5 18	—	—	—	15 04
66	8 27	5 18	—	—	15 02	14 24
64	8 11	5 17	—	14 10	14 01	13 55
62	7 57	5 17	12 24	13 08	13 26	13 34
60	7 45	5 16	11 46	12 34	13 01	13 16
58	7 35	5 15	11 20	12 09	12 41	13 02
56	7 26	5 15	10 59	11 49	12 24	12 49
54	7 18	5 13	10 41	11 32	12 10	12 38
52	7 11	5 12	10 26	11 18	11 58	12 28
50	7 04	5 12	10 13	11 05	11 47	12 19
45	6 50	5 08	9 47	10 39	11 24	12 00
40	6 39	5 05	9 26	10 19	11 05	11 45
35	6 29	5 01	9 08	10 02	10 50	11 32
30	6 21	4 58	8 53	9 47	10 36	11 21
20	6 06	4 49	8 28	9 22	10 13	11 01
10	5 53	4 40	8 06	9 00	9 53	10 44
0	5 40	4 28	7 45	8 40	9 34	10 28
10	5 28	4 14	7 25	8 20	9 16	10 12
20	5 14	3 56	7 03	7 58	8 56	9 55
30	4 59	3 31	6 38	7 33	8 32	9 35
35	4 50	3 15	6 23	7 18	8 19	9 23
40	4 39	2 53	6 06	7 01	8 03	9 10
45	4 27	2 25	5 45	6 40	7 44	8 54
50	4 12	1 45	5 19	6 14	7 20	8 34
52	4 05	1 19	5 06	6 01	7 09	8 25
54	3 57	0 40	4 52	5 47	6 56	8 14
56	3 48	////	4 35	5 30	6 40	8 02
58	3 39	////	4 15	5 10	6 23	7 48
60 S	3 27	////	3 50	4 44	6 01	7 32

Lat.	Sunset	Twlt. ends	Moonset 9	10	11	12
N °	h m	h m	h m	h m	h m	h m
72	13 26	18 05	—	—	—	—
70	14 09	18 05	—	—	—	—
68	14 38	18 06	—	—	—	18 33
66	15 00	18 07	—	—	16 42	19 12
64	15 17	18 08	—	15 40	17 43	19 39
62	15 31	18 09	15 32	16 42	18 17	20 00
60	15 42	18 09	16 10	17 16	18 42	20 17
58	15 53	18 11	16 37	17 41	19 01	20 31
56	16 02	18 12	16 58	18 01	19 18	20 43
54	16 10	18 13	17 15	18 17	19 31	20 53
52	16 17	18 14	17 30	18 31	19 43	21 03
50	16 23	18 15	17 43	18 44	19 54	21 11
45	16 37	18 18	18 10	19 09	20 16	21 28
40	16 48	18 21	18 31	19 29	20 34	21 43
35	16 58	18 25	18 48	19 46	20 49	21 55
30	17 07	18 29	19 03	20 01	21 02	22 05
20	17 22	18 38	19 29	20 25	21 24	22 23
10	17 35	18 48	19 51	20 46	21 43	22 38
0	17 48	19 00	20 11	21 06	22 00	22 53
10	18 00	19 14	20 32	21 26	22 18	23 07
20	18 14	19 33	20 54	21 47	22 36	23 22
30	18 29	19 58	21 19	22 11	22 58	23 40
35	18 39	20 16	21 34	22 25	23 10	23 50
40	18 49	20 36	21 52	22 41	23 24	24 01
45	19 02	21 05	22 12	23 01	23 41	24 14
50	19 17	21 48	22 38	23 25	24 02	0 02
52	19 24	22 14	22 51	23 37	24 12	0 12
54	19 32	22 58	23 06	23 50	24 23	0 23
56	19 41	////	23 23	24 06	0 06	0 35
58	19 51	////	23 43	24 24	0 24	0 50
60 S	20 03	////	24 09	0 09	0 46	1 07

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
9	13 58	10 30	9 07	2 28	10 50
10	14 53	10 30	9 05	2 24	10 46
11	15 47	10 31	9 03	2 20	10 43
12	16 41	10 32	9 02	2 16	10 39

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	9	10	11
°	′	′	′
0	14.0	14.7	15.4
4	14.0	14.7	15.4
8	14.0	14.7	15.4
12	14.1	14.7	15.4
16	14.1	14.7	15.4
20	14.1	14.7	15.4
24	14.1	14.7	15.4
28	14.2	14.8	15.4
32	14.2	14.8	15.4
36	14.3	14.8	15.4
40	14.3	14.8	15.4
44	14.4	14.9	15.5
48	14.5	14.9	15.5
52	14.5	14.9	15.5
56	14.6	15.0	15.5
60	14.7	15.0	15.5
64	14.7	15.1	15.5
68	14.8	15.1	15.5
72	14.9	15.2	15.5
76	15.0	15.2	15.5
80	15.1	15.3	15.5
84	15.1	15.3	15.5
88	15.2	15.3	15.5
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	9	10	11
°	′	′	′
0	16.4	16.1	15.6
4	16.4	16.1	15.6
8	16.4	16.0	15.6
12	16.4	16.0	15.6
16	16.4	16.0	15.6
20	16.3	16.0	15.6
24	16.3	16.0	15.6
28	16.3	16.0	15.6
32	16.2	15.9	15.6
36	16.2	15.9	15.6
40	16.1	15.9	15.6
44	16.1	15.8	15.6
48	16.0	15.8	15.6
52	15.9	15.8	15.6
56	15.9	15.7	15.6
60	15.8	15.7	15.6
64	15.7	15.6	15.6
68	15.6	15.6	15.6
72	15.6	15.6	15.6
76	15.5	15.5	15.5
80	15.4	15.5	15.5
84	15.3	15.4	15.5
88	15.2	15.4	15.5
90			

Subtract from table, back cover

Armistice Day 11

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
12 0	50 49.6	202 06.2	−10 11.9	224 24.4	− 1 24.5	326 02.0	+22 47.4	199 47.4	−10 12.7	118 43.7	89	−22 25.2	+ 79
1	65 52.1	217 05.7	13.0	239 25.4	25.1	341 04.7	47.4	214 49.5	12.8	133 11.6	89	22 17.3	+ 80
2	80 54.6	232 05.2	14.1	254 26.4	25.7	356 07.4	47.4	229 51.7	12.9	147 39.5	89	22 09.3	+ 81
3	95 57.0	247 04.7	•• 15.2	269 27.5	•• 26.3	11 10.1	•• 47.4	244 53.9	•• 13.0	162 07.4	89	•22 01.2	+ 82
4	110 59.5	262 04.2	16.4	284 28.5	26.9	26 12.8	47.4	259 56.1	13.1	176 35.3	90	21 53.0	+ 83
5	126 02.0	277 03.7	17.5	299 29.6	27.5	41 15.5	47.4	274 58.3	13.2	191 03.3	90	21 44.7	+ 85
6	141 04.4	292 03.2	−10 18.6	314 30.6	− 1 28.1	56 18.2	+22 47.4	290 00.5	−10 13.3	205 31.3	91	−21 36.2	+ 86
7	156 06.9	307 02.7	19.7	329 31.7	28.8	71 20.9	47.4	305 02.6	13.4	219 59.4	91	21 27.6	+ 88
8	171 09.4	322 02.2	20.9	344 32.7	29.4	86 23.6	47.4	320 04.8	13.5	234 27.5	92	21 18.8	+ 88
9	186 11.8	337 01.7	•• 22.0	359 33.8	•• 30.0	101 26.3	•• 47.4	335 07.0	•• 13.6	248 55.7	92	•21 10.0	+ 90
10	201 14.3	352 01.2	23.1	14 34.8	30.6	116 29.0	47.4	350 09.2	13.7	263 23.9	92	21 01.0	+ 91
11	216 16.8	7 00.7	24.2	29 35.8	31.2	131 31.7	47.4	5 11.4	13.8	277 52.1	93	20 51.9	+ 92
12	231 19.2	22 00.2	−10 25.4	44 36.9	− 1 31.8	146 34.5	+22 47.4	20 13.6	−10 13.9	292 20.4	93	−20 42.7	+ 93
13	246 21.7	36 59.7	26.5	59 37.9	32.4	161 37.2	47.3	35 15.7	14.0	306 48.7	94	20 33.4	+ 95
14	261 24.1	51 59.2	27.6	74 39.0	33.0	176 39.9	47.3	50 17.9	14.1	321 17.1	94	20 23.9	+ 96
15	276 26.6	66 58.7	•• 28.7	89 40.0	•• 33.7	191 42.6	•• 47.3	65 20.1	•• 14.2	335 45.5	94	•20 14.3	+ 97
16	291 29.1	81 58.2	29.9	104 41.1	34.3	206 45.3	47.3	80 22.3	14.2	350 13.9	95	20 04.6	+ 98
17	306 31.5	96 57.7	31.0	119 42.1	34.9	221 48.0	47.3	95 24.5	14.3	4 42.4	95	19 54.8	+ 99
18	321 34.0	111 57.2	−10 32.1	134 43.1	− 1 35.5	236 50.7	+22 47.3	110 26.7	−10 14.4	19 10.9	96	−19 44.9	+100
19	336 36.5	126 56.7	33.2	149 44.2	36.1	251 53.4	47.3	125 28.8	14.5	33 39.5	96	19 34.9	+102
20	351 38.9	141 56.2	34.3	164 45.2	36.7	266 56.1	47.3	140 31.0	14.6	48 08.1	97	19 24.7	+103
21	6 41.4	156 55.7	•• 35.5	179 46.3	•• 37.3	281 58.8	•• 47.3	155 33.2	•• 14.7	62 36.8	97	•19 14.4	+103
22	21 43.9	171 55.2	36.6	194 47.3	37.9	297 01.6	47.3	170 35.4	14.8	77 05.5	97	19 04.1	+105
23	36 46.3	186 54.7	37.7	209 48.4	38.5	312 04.3	47.3	185 37.6	14.9	91 34.2	98	18 53.6	+106
13 0	51 48.8	201 54.2	−10 38.8	224 49.4	− 1 39.2	327 07.0	+22 47.3	200 39.8	−10 15.0	106 03.0	98	−18 43.0	+107
1	66 51.3	216 53.7	39.9	239 50.5	39.8	342 09.7	47.3	215 41.9	15.1	120 31.8	99	18 32.3	+109
2	81 53.7	231 53.2	41.0	254 51.5	40.4	357 12.4	47.3	230 44.1	15.2	135 00.7	99	18 21.4	+109
3	96 56.2	246 52.7	•• 42.2	269 52.5	•• 41.0	12 15.1	•• 47.3	245 46.3	•• 15.3	149 29.6	99	•18 10.5	+110
4	111 58.6	261 52.2	43.3	284 53.6	41.6	27 17.8	47.3	260 48.5	15.4	163 58.5	100	17 59.5	+111
5	127 01.1	276 51.6	44.4	299 54.6	42.2	42 20.5	47.3	275 50.7	15.5	178 27.5	101	17 48.4	+113
6	142 03.6	291 51.1	−10 45.5	314 55.7	− 1 42.8	57 23.3	+22 47.2	290 52.9	−10 15.6	192 56.6	100	−17 37.1	+113
7	157 06.0	306 50.6	46.6	329 56.7	43.4	72 26.0	47.2	305 55.0	15.7	207 25.6	101	17 25.8	+115
8	172 08.5	321 50.1	47.7	344 57.8	44.1	87 28.7	47.2	320 57.2	15.8	221 54.7	102	17 14.3	+115
9	187 11.0	336 49.6	•• 48.9	359 58.8	•• 44.7	102 31.4	•• 47.2	335 59.4	•• 15.9	236 23.9	102	•17 02.8	+117
10	202 13.4	351 49.1	50.0	14 59.9	45.3	117 34.1	47.2	351 01.6	16.0	250 53.1	102	16 51.1	+117
11	217 15.9	6 48.6	51.1	30 00.9	45.9	132 36.8	47.2	6 03.8	16.1	265 22.3	103	16 39.4	+119
12	232 18.4	21 48.1	−10 52.2	45 01.9	− 1 46.5	147 39.6	+22 47.2	21 06.0	−10 16.2	279 51.6	103	−16 27.5	+119
13	247 20.8	36 47.6	53.3	60 03.0	47.1	162 42.3	47.2	36 08.1	16.3	294 20.9	104	16 15.6	+121
14	262 23.3	51 47.1	54.4	75 04.0	47.7	177 45.0	47.2	51 10.3	16.4	308 50.3	104	16 03.5	+121
15	277 25.8	66 46.5	•• 55.5	90 05.1	•• 48.3	192 47.7	•• 47.2	66 12.5	•• 16.5	323 19.7	104	•15 51.4	+122
16	292 28.2	81 46.0	56.6	105 06.1	48.9	207 50.4	47.2	81 14.7	16.6	337 49.1	104	15 39.2	+124
17	307 30.7	96 45.5	57.8	120 07.2	49.5	222 53.1	47.2	96 16.9	16.7	352 18.5	105	15 26.8	+124
18	322 33.1	111 45.0	−10 58.9	135 08.2	− 1 50.2	237 55.9	+22 47.2	111 19.1	−10 16.8	6 48.0	106	−15 14.4	+125
19	337 35.6	126 44.5	11 00.0	150 09.3	50.8	252 58.6	47.2	126 21.2	16.9	21 17.6	106	15 01.9	+126
20	352 38.1	141 44.0	01.1	165 10.3	51.4	268 01.3	47.2	141 23.4	17.0	35 47.2	106	14 49.3	+127
21	7 40.5	156 43.5	•• 02.2	180 11.3	•• 52.0	283 04.0	•• 47.2	156 25.6	•• 17.1	50 16.8	106	•14 36.6	+128
22	22 43.0	171 43.0	03.3	195 12.4	52.6	298 06.7	47.2	171 27.8	17.2	64 46.4	107	14 23.8	+128
23	37 45.5	186 42.4	04.4	210 13.4	53.2	313 09.4	47.1	186 30.0	17.3	79 16.1	107	14 11.0	+130
14 0	52 47.9	201 41.9	−11 05.5	225 14.5	− 1 53.8	328 12.2	+22 47.1	201 32.2	−10 17.4	93 45.8	107	−13 58.0	+130
1	67 50.4	216 41.4	06.6	240 15.5	54.4	343 14.9	47.1	216 34.3	17.5	108 15.5	108	13 45.0	+131
2	82 52.9	231 40.9	07.7	255 16.6	55.0	358 17.6	47.1	231 36.5	17.6	122 45.3	108	13 31.9	+132
3	97 55.3	246 40.4	•• 08.8	270 17.6	•• 55.7	13 20.3	•• 47.1	246 38.7	•• 17.7	137 15.1	108	•13 18.7	+133
4	112 57.8	261 39.9	10.0	285 18.6	56.3	28 23.0	47.1	261 40.9	17.8	151 44.9	109	13 05.4	+133
5	128 00.2	276 39.3	11.1	300 19.7	56.9	43 25.8	47.1	276 43.1	17.9	166 14.8	109	12 52.1	+135
6	143 02.7	291 38.8	−11 12.2	315 20.7	− 1 57.5	58 28.5	+22 47.1	291 45.3	−10 17.9	180 44.7	109	−12 38.6	+135
7	158 05.2	306 38.3	13.3	330 21.8	58.1	73 31.2	47.1	306 47.4	18.0	195 14.6	109	12 25.1	+136
8	173 07.6	321 37.8	14.4	345 22.8	58.7	88 33.9	47.1	321 49.6	18.1	209 44.5	110	12 11.5	+137
9	188 10.1	336 37.3	•• 15.5	0 23.9	•• 59.3	103 36.7	•• 47.1	336 51.8	•• 18.2	224 14.5	110	•11 57.8	+137
10	203 12.6	351 36.7	16.6	15 24.9	1 59.9	118 39.4	47.1	351 54.0	18.3	238 44.5	110	11 44.1	+138
11	218 15.0	6 36.2	17.7	30 26.0	2 00.5	133 42.1	47.1	6 56.2	18.4	253 14.5	111	11 30.3	+139
12	233 17.5	21 35.7	−11 18.8	45 27.0	− 2 01.1	148 44.8	+22 47.1	21 58.4	−10 18.5	267 44.6	111	−11 16.4	+140
13	248 20.0	36 35.2	19.9	60 28.1	01.8	163 47.5	47.1	37 00.6	18.6	282 14.7	110	11 02.4	+140
14	263 22.4	51 34.7	21.0	75 29.1	02.4	178 50.3	47.1	52 02.7	18.7	296 44.7	112	10 48.4	+141
15	278 24.9	66 34.1	•• 22.1	90 30.1	•• 03.0	193 53.0	•• 47.0	67 04.9	•• 18.8	311 14.9	111	•10 34.3	+142
16	293 27.4	81 33.6	23.2	105 31.2	03.6	208 55.7	47.0	82 07.1	18.9	325 45.0	111	10 20.1	+142
17	308 29.8	96 33.1	24.3	120 32.2	04.2	223 58.4	47.0	97 09.3	19.0	340 15.1	112	10 05.9	+143
18	323 32.3	111 32.6	−11 25.4	135 33.3	− 2 04.8	239 01.2	+22 47.0	112 11.5	−10 19.1	354 45.3	112	− 9 51.6	+144
19	338 34.7	126 32.1	26.5	150 34.3	05.4	254 03.9	47.0	127 13.7	19.2	9 15.5	112	9 37.2	+144
20	353 37.2	141 31.5	27.6	165 35.4	06.0	269 06.6	47.0	142 15.8	19.3	23 45.7	112	9 22.8	+145
21	8 39.7	156 31.0	•• 28.7	180 36.4	•• 06.6	284 09.3	•• 47.0	157 18.0	•• 19.4	38 15.9	113	• 9 08.3	+145
22	23 42.1	171 30.5	29.8	195 37.5	07.2	299 12.1	47.0	172 20.2	19.5	52 46.2	112	8 53.8	+146
23	38 44.6	186 30.0	30.9	210 38.5	07.9	314 14.8	47.0	187 22.4	19.6	67 16.4	113	8 39.2	+147
24	53 47.1	201 29.4	−11 32.0	225 39.5	− 2 08.5	329 17.5	+22 47.0	202 24.6	−10 19.7	81 46.7	113	− 8 24.5	+147
code	—	− 5	− 11	+ 11	− 6	+ 27	0	+ 21	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
12 0	183 58.0	−17 33.6
1	198 57.9	34.3
2	213 57.9	35.0
3	228 57.8	35.7
4	243 57.7	36.4
5	258 57.6	37.1
6	273 57.6	−17 37.7
7	288 57.5	38.4
8	303 57.4	39.1
9	318 57.3	39.8
10	333 57.2	40.5
11	348 57.2	41.1
12	3 57.1	−17 41.8
13	18 57.0	42.5
14	33 56.9	43.2
15	48 56.9	43.8
16	63 56.8	44.5
17	78 56.7	45.2
18	93 56.6	−17 45.9
19	108 56.5	46.5
20	123 56.4	47.2
21	138 56.4	47.9
22	153 56.3	48.6
23	168 56.2	49.2
13 0	183 56.1	−17 49.9
1	198 56.0	50.6
2	213 55.9	51.3
3	228 55.9	51.9
4	243 55.8	52.6
5	258 55.7	53.3
6	273 55.6	−17 53.9
7	288 55.5	54.6
8	303 55.4	55.3
9	318 55.3	55.9
10	333 55.3	56.6
11	348 55.2	57.3
12	3 55.1	−17 57.9
13	18 55.0	58.6
14	33 54.9	59.3
15	48 54.8	−17 59.9
16	63 54.7	18 00.6
17	78 54.6	01.3
18	93 54.5	−18 01.9
19	108 54.5	02.6
20	123 54.4	03.2
21	138 54.3	03.9
22	153 54.2	04.6
23	168 54.1	05.2
14 0	183 54.0	−18 05.9
1	198 53.9	06.5
2	213 53.8	07.2
3	228 53.7	07.8
4	243 53.6	08.5
5	258 53.5	09.2
6	273 53.4	−18 09.8
7	288 53.3	10.5
8	303 53.2	11.1
9	318 53.1	11.8
10	333 53.1	12.4
11	348 53.0	13.1
12	3 52.9	−18 13.7
13	18 52.8	14.4
14	33 52.7	15.0
15	48 52.6	15.7
16	63 52.5	16.3
17	78 52.4	17.0
18	93 52.3	−18 17.6
19	108 52.2	18.3
20	123 52.1	18.9
21	138 52.0	19.6
22	153 51.9	20.2
23	168 51.8	20.9
24	183 51.7	−18 21.5
code	—	− 7

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.1	−62 50.5
19	Adhara	255 47.4	−28 54.2
10	Aldebaran	291 40.4	+16 25.2
32	Alioth	167 00.1	+56 12.4
34	Alkaid	153 34.4	+49 32.4
55	Al Na'ir	28 39.6	−47 11.3
15	Alnilam	276 31.4	− 1 13.6
25	Alphard	218 40.0	− 8 27.4
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.3	−59 21.3
13	Bellatrix	279 19.7	+ 6 18.7
16	Betelg'se	271 49.4	+ 7 24.1
17	Canopus	264 15.6	−52 39.9
12	Capella	281 40.1	+45 57.2
53	Deneb	50 02.1	+45 07.2
28	Denebola	183 19.4	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.4	+61 59.7
14	Elnath	279 08.8	+28 34.3
47	Eltanin	91 07.3	+51 29.8
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.0
31	Gacrux	172 51.4	−56 51.2
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.2	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.5
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.5	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.6	−56 53.3
21	Pollux	244 22.1	+28 08.3
20	Procyon	245 46.3	+ 5 20.8
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.1	+12 11.6
11	Rigel	281 54.7	− 8 15.0
38	Rigil Kent.	140 53.7	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.9	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.4	−43 14.5
49	Vega	81 09.5	+38 44.5
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 12	13	14
h	m s	m s	m s
0	+15 52.2	+15 44.6	+15 36.2
6	+15 50.4	+15 42.6	+15 33.9
12	+15 48.5	+15 40.5	+15 31.6
18	+15 46.6	+15 38.3	+15 29.3
24	+15 44.6	+15 36.2	+15 26.9

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 12 h m	13 h m	14 h m	15 h m
72	10 31	5 28	▬	15 33	14 38	14 04
70	9 35	5 27	▬	14 55	14 21	13 57
68	9 03	5 27	15 04	14 28	14 08	13 51
66	8 39	5 25	14 24	14 08	13 56	13 47
64	8 20	5 24	13 55	13 51	13 47	13 43
62	8 05	5 23	13 34	13 37	13 39	13 39
60	7 52	5 22	13 16	13 26	13 31	13 36
58	7 42	5 21	13 02	13 15	13 25	13 33
56	7 32	5 20	12 49	13 06	13 20	13 31
54	7 24	5 18	12 38	12 59	13 15	13 29
52	7 16	5 17	12 28	12 51	13 10	13 27
50	7 09	5 16	12 19	12 45	13 06	13 25
45	6 55	5 12	12 00	12 31	12 57	13 21
40	6 43	5 08	11 45	12 19	12 49	13 17
35	6 32	5 04	11 32	12 09	12 43	13 14
30	6 23	5 00	11 21	12 01	12 37	13 12
20	6 08	4 51	11 01	11 46	12 27	13 07
10	5 54	4 40	10 44	11 32	12 18	13 03
0	5 41	4 29	10 28	11 20	12 10	12 59
10	5 28	4 14	10 12	11 07	12 02	12 56
20	5 14	3 55	9 55	10 54	11 53	12 51
30	4 57	3 29	9 35	10 39	11 43	12 47
35	4 48	3 11	9 23	10 30	11 37	12 44
40	4 37	2 50	9 10	10 19	11 30	12 41
45	4 24	2 20	8 54	10 07	11 22	12 38
50	4 08	1 34	8 34	9 52	11 12	12 34
52	4 00	1 06	8 25	9 46	11 08	12 32
54	3 52	0 09	8 14	9 38	11 03	12 30
56	3 43	////	8 02	9 29	10 58	12 27
58	3 32	////	7 48	9 19	10 52	12 25
60	3 20	////	7 32	9 08	10 45	12 22

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 12 h m	13 h m	14 h m	15 h m
72	12 57	17 55	▬	19 55	22 35	24 55
70	13 52	17 57	▬	20 31	22 49	24 58
68	14 25	17 58	18 33	20 56	23 01	25 01
66	14 49	18 00	19 12	21 15	23 10	25 03
64	15 08	18 02	19 39	21 30	23 18	25 05
62	15 23	18 03	20 00	21 43	23 25	25 06
60	15 36	18 04	20 17	21 54	23 30	25 07
58	15 46	18 05	20 31	22 03	23 35	25 09
56	15 56	18 07	20 43	22 11	23 40	25 10
54	16 04	18 08	20 53	22 18	23 44	25 11
52	16 12	18 10	21 03	22 25	23 48	25 11
50	16 19	18 11	21 11	22 30	23 51	25 12
45	16 34	18 16	21 28	22 43	23 58	25 14
40	16 46	18 19	21 43	22 53	24 04	0 04
35	16 56	18 23	21 55	23 02	24 09	0 09
30	17 05	18 27	22 05	23 09	24 13	0 13
20	17 21	18 37	22 23	23 22	24 21	0 21
10	17 35	18 48	22 38	23 33	24 27	0 27
0	17 48	19 00	22 53	23 44	24 33	0 33
10	18 01	19 15	23 07	23 54	24 39	0 39
20	18 15	19 35	23 22	24 05	0 05	0 46
30	18 32	20 02	23 40	24 18	0 18	0 53
35	18 42	20 20	23 50	24 25	0 25	0 57
40	18 53	20 42	24 01	0 01	0 33	1 02
45	19 06	21 12	24 14	0 14	0 43	1 07
50	19 22	21 58	0 02	0 31	0 54	1 13
52	19 29	22 28	0 12	0 38	0 59	1 16
54	19 38	////	0 23	0 47	1 05	1 19
56	19 47	////	0 35	0 56	1 11	1 23
58	19 58	////	0 50	1 07	1 18	1 27
60	20 10	////	1 07	1 19	1 26	1 31

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
12	16 41	10 32	9 02	2 16	10 39
13	17 32	10 33	9 00	2 11	10 36
14	18 22	10 34	8 58	2 07	10 32
15	19 11	10 34	8 57	2 03	10 29

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	12	13	14
°	′	′	′
0	16.2	16.9	17.7
4	16.2	16.9	17.7
8	16.2	16.9	17.7
12	16.2	16.9	17.7
16	16.2	16.9	17.6
20	16.2	16.9	17.6
24	16.1	16.8	17.5
28	16.1	16.8	17.5
32	16.1	16.8	17.4
36	16.1	16.7	17.4
40	16.1	16.7	17.3
44	16.0	16.6	17.2
48	16.0	16.6	17.1
52	16.0	16.5	17.0
56	16.0	16.4	16.9
60	15.9	16.4	16.8
64	15.9	16.3	16.7
68	15.9	16.2	16.6
72	15.8	16.2	16.5
76	15.8	16.1	16.4
80	15.8	16.0	16.3
84	15.7	15.9	16.1
88	15.7	15.9	16.0
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	12	13	14
°	′	′	′
0	15.2	14.8	14.3
4	15.2	14.8	14.3
8	15.2	14.8	14.3
12	15.2	14.8	14.4
16	15.2	14.8	14.4
20	15.2	14.8	14.4
24	15.2	14.9	14.5
28	15.3	14.9	14.5
32	15.3	14.9	14.6
36	15.3	15.0	14.7
40	15.3	15.0	14.8
44	15.3	15.1	14.8
48	15.4	15.1	14.9
52	15.4	15.2	15.0
56	15.4	15.3	15.1
60	15.5	15.3	15.2
64	15.5	15.4	15.3
68	15.5	15.5	15.4
72	15.5	15.5	15.5
76	15.6	15.6	15.7
80	15.6	15.7	15.8
84	15.7	15.8	15.9
88	15.7	15.8	16.0
90			

Subtract from table, back cover

First Quarter 14

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
15 0	53 47.1	201 29.4	−11 32.0	225 39.5	− 2 08.5	329 17.5	+22 47.0	202 24.6	−10 19.7	81 46.7	113	− 8 24.5	+147
1	68 49.5	216 28.9	33.1	240 40.6	09.1	344 20.2	47.0	217 26.8	19.8	96 17.0	113	8 09.8	+148
2	83 52.0	231 28.4	34.2	255 41.6	09.7	359 23.0	47.0	232 29.0	19.9	110 47.3	113	7 55.0	+148
3	98 54.5	246 27.9	35.3	270 42.7	10.3	14 25.7	47.0	247 31.1	20.0	125 17.6	113	7 40.2	+149
4	113 56.9	261 27.3	36.4	285 43.7	10.9	29 28.4	47.0	262 33.3	20.1	139 47.9	113	7 25.3	+149
5	128 59.4	276 26.8	37.5	300 44.8	11.5	44 31.2	47.0	277 35.5	20.2	154 18.2	113	7 10.4	+150
6	144 01.9	291 26.3	−11 38.6	315 45.8	− 2 12.1	59 33.9	+22 46.9	292 37.7	−10 20.3	168 48.5	114	− 6 55.4	+151
7	159 04.3	306 25.7	39.7	330 46.9	12.7	74 36.6	46.9	307 39.9	20.4	183 18.9	113	6 40.3	+150
8	174 06.8	321 25.2	40.7	345 47.9	13.3	89 39.3	46.9	322 42.1	20.5	197 49.2	113	6 25.3	+152
9	189 09.2	336 24.7	41.8	0 48.9	13.9	104 42.1	46.9	337 44.2	20.6	212 19.5	114	6 10.1	+151
10	204 11.7	351 24.2	42.9	15 50.0	14.6	119 44.8	46.9	352 46.4	20.7	226 49.9	113	5 55.0	+153
11	219 14.2	6 23.6	44.0	30 51.0	15.2	134 47.5	46.9	7 48.6	20.8	241 20.2	113	5 39.7	+152
12	234 16.6	21 23.1	−11 45.1	45 52.1	− 2 15.8	149 50.3	+22 46.9	22 50.8	−10 20.8	255 50.5	114	− 5 24.5	+153
13	249 19.1	36 22.6	46.2	60 53.1	16.4	164 53.0	46.9	37 53.0	20.9	270 20.9	113	5 09.2	+154
14	264 21.6	51 22.0	47.3	75 54.2	17.0	179 55.7	46.9	52 55.2	21.0	284 51.2	114	4 53.8	+153
15	279 24.0	66 21.5	48.4	90 55.2	17.6	194 58.5	46.9	67 57.4	21.1	299 21.6	113	4 38.5	+155
16	294 26.5	81 21.0	49.5	105 56.3	18.2	210 01.2	46.9	82 59.5	21.2	313 51.9	113	4 23.0	+154
17	309 29.0	96 20.4	50.6	120 57.3	18.8	225 03.9	46.9	98 01.7	21.3	328 22.2	114	4 07.6	+155
18	324 31.4	111 19.9	−11 51.7	135 58.3	− 2 19.4	240 06.6	+22 46.9	113 03.9	−10 21.4	342 52.6	113	− 3 52.1	+155
19	339 33.9	126 19.4	52.7	150 59.4	20.0	255 09.4	46.9	128 06.1	21.5	357 22.9	113	3 36.6	+156
20	354 36.3	141 18.8	53.8	166 00.4	20.6	270 12.1	46.9	143 08.3	21.6	11 53.2	113	3 21.0	+155
21	9 38.8	156 18.3	54.9	181 01.5	21.2	285 14.8	46.8	158 10.5	21.7	26 23.5	113	3 05.5	+157
22	24 41.3	171 17.8	56.0	196 02.5	21.9	300 17.6	46.8	173 12.7	21.8	40 53.8	112	2 49.8	+156
23	39 43.7	186 17.2	57.1	211 03.6	22.5	315 20.3	46.8	188 14.8	21.9	55 24.0	113	2 34.2	+157
16 0	54 46.2	201 16.7	−11 58.2	226 04.6	− 2 23.1	330 23.0	+22 46.8	203 17.0	−10 22.0	69 54.3	112	− 2 18.5	+156
1	69 48.7	216 16.2	11 59.3	241 05.7	23.7	345 25.8	46.8	218 19.2	22.1	84 24.5	113	2 02.9	+158
2	84 51.1	231 15.6	12 00.3	256 06.7	24.3	0 28.5	46.8	233 21.4	22.2	98 54.8	112	1 47.1	+157
3	99 53.6	246 15.1	01.4	271 07.7	24.9	15 31.2	46.8	248 23.6	22.3	113 25.0	112	1 31.4	+157
4	114 56.1	261 14.6	02.5	286 08.8	25.5	30 34.0	46.8	263 25.8	22.4	127 55.2	112	1 15.7	+158
5	129 58.5	276 14.0	03.6	301 09.8	26.1	45 36.7	46.8	278 28.0	22.5	142 25.4	111	0 59.9	+158
6	145 01.0	291 13.5	−12 04.7	316 10.9	− 2 26.7	60 39.4	+22 46.8	293 30.1	−10 22.6	156 55.5	111	− 0 44.1	+158
7	160 03.5	306 12.9	05.8	331 11.9	27.3	75 42.2	46.8	308 32.3	22.7	171 25.6	112	0 28.3	+158
8	175 05.9	321 12.4	06.8	346 13.0	27.9	90 44.9	46.8	323 34.5	22.8	185 55.8	110	− 0 12.5	+159
9	190 08.4	336 11.9	07.9	1 14.0	28.5	105 47.6	46.8	338 36.7	22.9	200 25.8	111	+ 0 03.4	+158
10	205 10.8	351 11.3	09.0	16 15.1	29.2	120 50.4	46.8	353 38.9	23.0	214 55.9	110	0 19.2	+159
11	220 13.3	6 10.8	10.1	31 16.1	29.8	135 53.1	46.8	8 41.1	23.1	229 25.9	111	0 35.1	+158
12	235 15.8	21 10.2	−12 11.2	46 17.1	− 2 30.4	150 55.9	+22 46.7	23 43.3	−10 23.1	243 56.0	109	+ 0 50.9	+159
13	250 18.2	36 09.7	12.2	61 18.2	31.0	165 58.6	46.7	38 45.4	23.2	258 25.9	110	1 06.8	+159
14	265 20.7	51 09.2	13.3	76 19.2	31.6	181 01.3	46.7	53 47.6	23.3	272 55.9	109	1 22.7	+159
15	280 23.2	66 08.6	14.4	91 20.3	32.2	196 04.1	46.7	68 49.8	23.4	287 25.8	109	1 38.6	+159
16	295 25.6	81 08.1	15.5	106 21.3	32.8	211 06.8	46.7	83 52.0	23.5	301 55.7	109	1 54.5	+158
17	310 28.1	96 07.5	16.6	121 22.4	33.4	226 09.5	46.7	98 54.2	23.6	316 25.6	108	2 10.3	+159
18	325 30.6	111 07.0	−12 17.6	136 23.4	− 2 34.0	241 12.3	+22 46.7	113 56.4	−10 23.7	330 55.4	108	+ 2 26.2	+159
19	340 33.0	126 06.4	18.7	151 24.5	34.6	256 15.0	46.7	128 58.6	23.8	345 25.2	107	2 42.1	+159
20	355 35.5	141 05.9	19.8	166 25.5	35.2	271 17.8	46.7	144 00.7	23.9	359 54.9	107	2 58.0	+159
21	10 38.0	156 05.4	20.9	181 26.6	35.8	286 20.5	46.7	159 02.9	24.0	14 24.6	107	3 13.9	+158
22	25 40.4	171 04.8	21.9	196 27.6	36.4	301 23.2	46.7	174 05.1	24.1	28 54.3	106	3 29.7	+159
23	40 42.9	186 04.3	23.0	211 28.6	37.1	316 26.0	46.7	189 07.3	24.2	43 23.9	106	3 45.6	+158
17 0	55 45.3	201 03.7	−12 24.1	226 29.7	− 2 37.7	331 28.7	+22 46.7	204 09.5	−10 24.3	57 53.5	106	+ 4 01.4	+159
1	70 47.8	216 03.2	25.2	241 30.7	38.3	346 31.5	46.7	219 11.7	24.4	72 23.1	105	4 17.3	+158
2	85 50.3	231 02.6	26.2	256 31.8	38.9	1 34.2	46.6	234 13.9	24.5	86 52.6	104	4 33.1	+158
3	100 52.7	246 02.1	27.3	271 32.8	39.5	16 36.9	46.6	249 16.1	24.6	101 22.0	104	+ 4 48.9	+158
4	115 55.2	261 01.5	28.4	286 33.9	40.1	31 39.7	46.6	264 18.2	24.7	115 51.4	104	5 04.7	+157
5	130 57.7	276 01.0	29.5	301 34.9	40.7	46 42.4	46.6	279 20.4	24.8	130 20.8	103	5 20.4	+158
6	146 00.1	291 00.4	−12 30.5	316 36.0	− 2 41.3	61 45.2	+22 46.6	294 22.6	−10 24.9	144 50.1	103	+ 5 36.2	+157
7	161 02.6	305 59.9	31.6	331 37.0	41.9	76 47.9	46.6	309 24.8	25.0	159 19.4	102	5 51.9	+157
8	176 05.1	320 59.3	32.7	346 38.0	42.5	91 50.6	46.6	324 27.0	25.1	173 48.6	102	6 07.6	+157
9	191 07.5	335 58.8	33.7	1 39.1	43.1	106 53.4	46.6	339 29.2	25.2	188 17.8	101	+ 6 23.3	+156
10	206 10.0	350 58.2	34.8	16 40.1	43.7	121 56.1	46.6	354 31.4	25.2	202 46.9	100	6 38.9	+157
11	221 12.4	5 57.7	35.9	31 41.2	44.3	136 58.9	46.6	9 33.6	25.3	217 15.9	101	6 54.6	+155
12	236 14.9	20 57.1	−12 36.9	46 42.2	− 2 44.9	152 01.6	+22 46.6	24 35.7	−10 25.4	231 45.0	99	+ 7 10.1	+156
13	251 17.4	35 56.6	38.0	61 43.3	45.6	167 04.4	46.6	39 37.9	25.5	246 13.9	99	7 25.7	+155
14	266 19.8	50 56.0	39.1	76 44.3	46.2	182 07.1	46.6	54 40.1	25.6	260 42.8	98	7 41.2	+155
15	281 22.3	65 55.5	40.1	91 45.4	46.8	197 09.8	46.6	69 42.3	25.7	275 11.6	98	+ 7 56.7	+155
16	296 24.8	80 54.9	41.2	106 46.4	47.4	212 12.6	46.5	84 44.5	25.8	289 40.4	97	8 12.2	+154
17	311 27.2	95 54.4	42.3	121 47.4	48.0	227 15.3	46.5	99 46.7	25.9	304 09.1	97	8 27.6	+153
18	326 29.7	110 53.8	−12 43.3	136 48.5	− 2 48.6	242 18.1	+22 46.5	114 48.9	−10 26.0	318 37.8	96	+ 8 42.9	+154
19	341 32.2	125 53.3	44.4	151 49.5	49.2	257 20.8	46.5	129 51.0	26.1	333 06.4	95	8 58.3	+152
20	356 34.6	140 52.7	45.5	166 50.6	49.8	272 23.6	46.5	144 53.2	26.2	347 34.9	95	9 13.5	+153
21	11 37.1	155 52.2	46.5	181 51.6	50.4	287 26.3	46.5	159 55.4	26.3	2 03.4	94	9 28.8	+152
22	26 39.6	170 51.6	47.6	196 52.7	51.0	302 29.1	46.5	174 57.6	26.4	16 31.8	93	9 44.0	+151
23	41 42.0	185 51.1	48.6	211 53.7	51.6	317 31.8	46.5	189 59.8	26.5	31 00.1	93	9 59.1	+151
24	56 44.5	200 50.5	−12 49.7	226 54.8	− 2 52.2	332 34.6	+22 46.5	205 02.0	−10 26.6	45 28.4	92	+10 14.2	+150
code	—	− 5	− 10	+ 11	− 6	+ 27	0	+ 21	− 1				

GMT	h	SUN GHA ° ′	Dec. ° ′
15	0	183 51.7	−18 21.5
	1	198 51.6	22.2
	2	213 51.5	22.8
	3	228 51.4	23.4
	4	243 51.3	24.1
	5	258 51.2	24.7
	6	273 51.1	−18 25.4
	7	288 51.0	26.0
	8	303 50.9	26.7
	9	318 50.7	27.3
	10	333 50.6	27.9
	11	348 50.5	28.6
	12	3 50.4	−18 29.2
	13	18 50.3	29.9
	14	33 50.2	30.5
	15	48 50.1	31.1
	16	63 50.0	31.8
	17	78 49.9	32.4
	18	93 49.8	−18 33.0
	19	108 49.7	33.7
	20	123 49.6	34.3
	21	138 49.5	34.9
	22	153 49.4	35.6
	23	168 49.3	36.2
16	0	183 49.1	−18 36.8
	1	198 49.0	37.5
	2	213 48.9	38.1
	3	228 48.8	38.7
	4	243 48.7	39.4
	5	258 48.6	40.0
	6	273 48.5	−18 40.6
	7	288 48.4	41.2
	8	303 48.3	41.9
	9	318 48.1	42.5
	10	333 48.0	43.1
	11	348 47.9	43.7
	12	3 47.8	−18 44.4
	13	18 47.7	45.0
	14	33 47.6	45.6
	15	48 47.5	46.2
	16	63 47.3	46.9
	17	78 47.2	47.5
	18	93 47.1	−18 48.1
	19	108 47.0	48.7
	20	123 46.9	49.3
	21	138 46.8	50.0
	22	153 46.7	50.6
	23	168 46.5	51.2
17	0	183 46.4	−18 51.8
	1	198 46.3	52.4
	2	213 46.2	53.1
	3	228 46.1	53.7
	4	243 45.9	54.3
	5	258 45.8	54.9
	6	273 45.7	−18 55.5
	7	288 45.6	56.1
	8	303 45.5	56.7
	9	318 45.3	57.4
	10	333 45.2	58.0
	11	348 45.1	58.6
	12	3 45.0	−18 59.2
	13	18 44.8	18 59.8
	14	33 44.7	19 00.4
	15	48 44.6	01.0
	16	63 44.5	01.6
	17	78 44.4	02.2
	18	93 44.2	−19 02.8
	19	108 44.1	03.5
	20	123 44.0	04.1
	21	138 43.9	04.7
	22	153 43.7	05.3
	23	168 43.6	05.9
	24	183 43.5	−19 06.5
code		—	− 6

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.1	−62 50.5
19	Adhara	255 47.4	−28 54.3
10	Aldebaran	291 40.4	+16 25.2
32	Alioth	167 00.1	+56 12.3
34	Alkaid	153 34.3	+49 32.4
55	Al Na'ir	28 39.6	−47 11.3
15	Alnilam	276 31.4	− 1 13.6
25	Alphard	218 40.0	− 8 27.4
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.4
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.2	−59 21.3
13	Bellatrix	279 19.6	+ 6 18.7
16	Beteig'se	271 49.4	+ 7 24.1
17	Canopus	264 15.6	−52 39.9
12	Capella	281 40.1	+45 57.3
53	Deneb	50 02.2	+45 07.2
28	Denebola	183 19.3	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.4	+61 59.7
14	Elnath	279 08.8	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.1
31	Gacrux	172 51.4	−56 51.1
29	Gienah	176 38.6	−17 17.1
35	Hadar	149 52.2	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.5
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.4	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.7	−56 53.3
21	Pollux	244 22.1	+28 08.3
20	Procyon	245 46.3	+ 5 20.7
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.0	+12 11.6
11	Rigel	281 54.7	− 8 15.0
38	Rigil Kent.	140 53.7	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.9	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.4	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bi	137 55.3	−15 51.1

GMT h	Equation of Time (App.—Mean) 15 m s	16 m s	17 m s
0	+15 26.9	+15 16.8	+15 05.9
6	+15 24.4	+15 14.2	+15 03.0
12	+15 22.0	+15 11.5	+15 00.1
18	+15 19.4	+15 08.7	+14 57.2
24	+15 16.8	+15 05.9	+14 54.2

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 15 h m	16 h m	17 h m	18 h m
72	11 22	5 39	14 04	13 34	13 03	12 22
70	9 55	5 36	13 57	13 35	13 13	12 45
68	9 17	5 35	13 51	13 37	13 22	13 04
66	8 50	5 33	13 47	13 38	13 29	13 18
64	8 30	5 31	13 43	13 39	13 35	13 31
62	8 14	5 30	13 39	13 39	13 40	13 41
60	8 00	5 27	13 36	13 40	13 44	13 50
58	7 48	5 26	13 33	13 41	13 49	13 58
56	7 38	5 24	13 31	13 41	13 52	14 05
54	7 29	5 22	13 29	13 42	13 55	14 12
52	7 21	5 22	13 27	13 42	13 59	14 17
50	7 14	5 19	13 25	13 43	14 01	14 23
45	6 59	5 15	13 21	13 43	14 07	14 34
40	6 46	5 11	13 17	13 44	14 12	14 43
35	6 35	5 07	13 14	13 45	14 17	14 51
30	6 26	5 02	13 12	13 46	14 21	14 58
20	6 09	4 53	13 07	13 47	14 27	15 11
10	5 55	4 42	13 03	13 48	14 33	15 22
0	5 41	4 28	12 59	13 49	14 39	15 32
10	5 28	4 13	12 56	13 50	14 45	15 43
20	5 13	3 53	12 51	13 51	14 51	15 54
30	4 56	3 26	12 47	13 52	14 58	16 07
35	4 46	3 08	12 44	13 53	15 03	16 15
40	4 34	2 45	12 41	13 53	15 07	16 23
45	4 20	2 13	12 38	13 55	15 13	16 34
50	4 04	1 24	12 34	13 56	15 20	16 46
52	3 56	0 49	12 32	13 56	15 23	16 52
54	3 47	////	12 30	13 57	15 26	16 58
56	3 37	////	12 27	13 58	15 30	17 06
58	3 26	////	12 25	13 58	15 34	17 14
60	3 13	////	12 22	13 59	15 39	17 23
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 15 h m	16 h m	17 h m	18 h m
72	12 06	17 46	24 55	0 55	3 14	5 45
70	13 34	17 49	24 58	0 58	3 07	5 24
68	14 12	17 51	25 01	1 01	3 01	5 08
66	14 39	17 54	25 03	1 03	2 56	4 55
64	14 59	17 56	25 05	1 05	2 52	4 44
62	15 15	17 57	25 06	1 06	2 49	4 35
60	15 29	17 59	25 07	1 07	2 46	4 27
58	15 41	18 01	25 09	1 09	2 43	4 21
56	15 51	18 03	25 10	1 10	2 41	4 15
54	16 00	18 05	25 11	1 11	2 39	4 09
52	16 08	18 07	25 11	1 11	2 37	4 05
50	16 15	18 08	25 12	1 12	2 35	4 00
45	16 31	18 13	25 14	1 14	2 31	3 51
40	16 43	18 17	0 04	1 15	2 28	3 43
35	16 54	18 22	0 09	1 17	2 26	3 37
30	17 04	18 27	0 13	1 18	2 23	3 31
20	17 20	18 36	0 21	1 20	2 19	3 21
10	17 35	18 48	0 27	1 21	2 16	3 12
0	17 48	19 01	0 33	1 22	2 12	3 04
10	18 02	19 17	0 39	1 24	2 09	2 56
20	18 17	19 37	0 46	1 25	2 05	2 47
30	18 34	20 05	0 53	1 27	2 01	2 37
35	18 45	20 24	0 57	1 28	1 59	2 32
40	18 56	20 47	1 02	1 29	1 56	2 25
45	19 10	21 19	1 07	1 30	1 53	2 18
50	19 27	22 10	1 13	1 32	1 50	2 09
52	19 35	22 47	1 16	1 32	1 48	2 05
54	19 44	////	1 19	1 33	1 46	2 01
56	19 54	////	1 23	1 34	1 44	1 56
58	20 05	////	1 27	1 34	1 42	1 50
60	20 19	////	1 31	1 35	1 39	1 44
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
15	19 11	10 34	8 57	2 03	10 29
16	20 00	10 35	8 55	1 58	10 25
17	20 52	10 36	8 53	1 54	10 22
18	21 45	10 37	8 52	1 49	10 18

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	15 ′	16 ′	17 ′
0	18.5	19.2	19.7
4	18.5	19.2	19.7
8	18.4	19.2	19.7
12	18.4	19.2	19.7
16	18.4	19.1	19.6
20	18.3	19.0	19.5
24	18.2	18.9	19.4
28	18.2	18.9	19.3
32	18.1	18.7	19.2
36	18.0	18.6	19.1
40	17.9	18.5	18.9
44	17.8	18.4	18.7
48	17.7	18.2	18.6
52	17.5	18.0	18.4
56	17.4	17.9	18.2
60	17.3	17.7	18.0
64	17.1	17.5	17.8
68	17.0	17.3	17.6
72	16.8	17.1	17.4
76	16.7	16.9	17.1
80	16.5	16.7	16.9
84	16.3	16.5	16.7
88	16.2	16.4	16.5
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	15 ′	16 ′	17 ′
0	13.9	13.4	13.2
4	13.9	13.5	13.2
8	13.9	13.5	13.2
12	13.9	13.5	13.2
16	14.0	13.6	13.3
20	14.0	13.7	13.4
24	14.1	13.7	13.5
28	14.2	13.8	13.6
32	14.3	13.9	13.7
36	14.4	14.1	13.8
40	14.5	14.2	14.0
44	14.6	14.3	14.2
48	14.7	14.5	14.3
52	14.8	14.6	14.5
56	15.0	14.8	14.7
60	15.1	15.0	14.9
64	15.2	15.2	15.1
68	15.4	15.3	15.3
72	15.5	15.5	15.5
76	15.7	15.7	15.8
80	15.9	15.9	16.0
84	16.0	16.1	16.2
88	16.1	16.3	16.4
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
18 0	56 44.5	200 50.5	−12 49.7	226 54.8	− 2 52.2	332 34.6	+22 46.5	205 02.0	−10 26.6	45 28.4	92	+10 14.2	+150
1	71 46.9	215 49.9	50.8	241 55.8	52.8	347 37.3	46.5	220 04.2	26.7	59 56.6	91	10 29.2	+150
2	86 49.4	230 49.4	51.8	256 56.8	53.4	2 40.0	46.5	235 06.4	26.8	74 24.7	91	10 44.2	+149
3	101 51.9	245 48.8	52.9	271 57.9	54.0	17 42.8	46.5	250 08.6	26.9	88 52.8	90	10 59.1	+148
4	116 54.3	260 48.3	53.9	286 58.9	54.6	32 45.5	46.5	265 10.7	27.0	103 20.8	89	11 13.9	+148
5	131 56.8	275 47.7	55.0	302 00.0	55.3	47 48.3	46.4	280 12.9	27.0	117 48.7	88	11 28.7	+148
6	146 59.3	290 47.1	−12 56.1	317 01.0	− 2 55.9	62 51.0	+22 46.4	295 15.1	−10 27.1	132 16.5	88	+11 43.5	+146
7	162 01.7	305 46.6	57.1	332 02.1	56.5	77 53.8	46.4	310 17.3	27.2	146 44.3	87	11 58.1	+146
8	177 04.2	320 46.0	58.2	347 03.1	57.1	92 56.5	46.4	325 19.5	27.3	161 12.0	87	12 12.7	+145
9	192 06.7	335 45.5	−12 59.2	2 04.2	57.7	107 59.3	46.4	340 21.7	27.4	175 39.7	85	12 27.2	+145
10	207 09.1	350 44.9	13 00.3	17 05.2	58.3	123 02.0	46.4	355 23.9	27.5	190 07.2	85	12 41.7	+144
11	222 11.6	5 44.3	01.3	32 06.3	58.9	138 04.8	46.4	10 26.1	27.6	204 34.7	84	12 56.1	+143
12	237 14.1	20 43.8	−13 02.4	47 07.3	− 2 59.5	153 07.5	+22 46.4	25 28.2	−10 27.7	219 02.1	83	+13 10.4	+142
13	252 16.5	35 43.2	03.5	62 08.3	3 00.1	168 10.3	46.4	40 30.4	27.8	233 29.4	83	13 24.6	+142
14	267 19.0	50 42.7	04.5	77 09.4	00.7	183 13.0	46.4	55 32.6	27.9	247 56.7	82	13 38.8	+141
15	282 21.4	65 42.1	05.6	92 10.4	01.3	198 15.8	46.4	70 34.8	28.0	262 23.9	81	+13 52.9	+139
16	297 23.9	80 41.5	06.6	107 11.5	01.9	213 18.5	46.4	85 37.0	28.1	276 51.0	80	14 06.8	+140
17	312 26.4	95 41.0	07.7	122 12.5	02.5	228 21.3	46.4	100 39.2	28.2	291 18.0	80	14 20.8	+138
18	327 28.8	110 40.4	−13 08.7	137 13.6	− 3 03.1	243 24.0	+22 46.3	115 41.4	−10 28.3	305 45.0	78	+14 34.6	+137
19	342 31.3	125 39.8	09.8	152 14.6	03.7	258 26.8	46.3	130 43.6	28.4	320 11.8	78	14 48.3	+137
20	357 33.8	140 39.3	10.8	167 15.7	04.3	273 29.5	46.3	145 45.8	28.5	334 38.6	77	15 02.0	+135
21	12 36.2	155 38.7	11.9	182 16.7	04.9	288 32.3	46.3	160 47.9	28.6	349 05.3	76	+15 15.5	+135
22	27 38.7	170 38.1	12.9	197 17.7	05.5	303 35.0	46.3	175 50.1	28.6	3 31.9	76	15 29.0	+133
23	42 41.2	185 37.6	14.0	212 18.8	06.1	318 37.8	46.3	190 52.3	28.7	17 58.5	74	15 42.3	+133
19 0	57 43.6	200 37.0	−13 15.0	227 19.8	− 3 06.8	333 40.5	+22 46.3	205 54.5	−10 28.8	32 24.9	74	+15 55.6	+131
1	72 46.1	215 36.4	16.1	242 20.9	07.4	348 43.3	46.3	220 56.7	28.9	46 51.3	73	16 08.7	+131
2	87 48.5	230 35.9	17.1	257 21.9	08.0	3 46.0	46.3	235 58.9	29.0	61 17.6	73	16 21.8	+130
3	102 51.0	245 35.3	18.2	272 23.0	08.6	18 48.8	46.3	251 01.1	29.1	75 43.9	71	+16 34.8	+128
4	117 53.5	260 34.7	19.2	287 24.0	09.2	33 51.6	46.3	266 03.3	29.2	90 10.0	71	16 47.6	+128
5	132 55.9	275 34.2	20.3	302 25.1	09.8	48 54.3	46.3	281 05.4	29.3	104 36.1	69	17 00.4	+126
6	147 58.4	290 33.6	−13 21.3	317 26.1	− 3 10.4	63 57.1	+22 46.3	296 07.6	−10 29.4	119 02.0	69	+17 13.0	+125
7	163 00.9	305 33.0	22.3	332 27.1	11.0	78 59.8	46.2	311 09.8	29.5	133 27.9	69	17 25.5	+125
8	178 03.3	320 32.5	23.4	347 28.2	11.6	94 02.6	46.2	326 12.0	29.6	147 53.8	67	17 38.0	+123
9	193 05.8	335 31.9	24.4	2 29.2	12.2	109 05.3	46.2	341 14.2	29.7	162 19.5	66	+17 50.3	+121
10	208 08.3	350 31.3	25.5	17 30.3	12.8	124 08.1	46.2	356 16.4	29.8	176 45.1	66	18 02.4	+121
11	223 10.7	5 30.7	26.5	32 31.3	13.4	139 10.8	46.2	11 18.6	29.9	191 10.7	65	18 14.5	+120
12	238 13.2	20 30.2	−13 27.6	47 32.4	− 3 14.0	154 13.6	+22 46.2	26 20.8	−10 30.0	205 36.2	64	+18 26.5	+118
13	253 15.7	35 29.6	28.6	62 33.4	14.6	169 16.3	46.2	41 23.0	30.1	220 01.6	64	18 38.3	+117
14	268 18.1	50 29.0	29.6	77 34.5	15.2	184 19.1	46.2	56 25.2	30.1	234 27.0	62	18 50.0	+116
15	283 20.6	65 28.5	30.7	92 35.5	15.8	199 21.9	46.2	71 27.3	30.2	248 52.2	62	+19 01.6	+114
16	298 23.0	80 27.9	31.7	107 36.6	16.4	214 24.6	46.2	86 29.5	30.3	263 17.4	61	19 13.0	+113
17	313 25.5	95 27.3	32.8	122 37.6	17.0	229 27.4	46.2	101 31.7	30.4	277 42.5	60	19 24.3	+112
18	328 28.0	110 26.7	−13 33.8	137 38.6	− 3 17.6	244 30.1	+22 46.2	116 33.9	−10 30.5	292 07.5	60	+19 35.5	+111
19	343 30.4	125 26.2	34.8	152 39.7	18.2	259 32.9	46.2	131 36.1	30.6	306 32.5	58	19 46.6	+109
20	358 32.9	140 25.6	35.9	167 40.7	18.8	274 35.6	46.1	146 38.3	30.7	320 57.3	58	19 57.5	+108
21	13 35.4	155 25.0	36.9	182 41.8	19.4	289 38.4	46.1	161 40.5	30.8	335 22.1	57	+20 08.3	+106
22	28 37.8	170 24.4	37.9	197 42.8	20.0	304 41.2	46.1	176 42.7	30.9	349 46.8	57	20 18.9	+106
23	43 40.3	185 23.8	39.0	212 43.9	20.6	319 43.9	46.1	191 44.9	31.0	4 11.5	55	20 29.5	+103
20 0	58 42.8	200 23.3	−13 40.0	227 44.9	− 3 21.3	334 46.7	+22 46.1	206 47.0	−10 31.1	18 36.0	55	+20 39.8	+103
1	73 45.2	215 22.7	41.0	242 46.0	21.9	349 49.4	46.1	221 49.2	31.2	33 00.5	54	20 50.1	+100
2	88 47.7	230 22.1	42.1	257 47.0	22.5	4 52.2	46.1	236 51.4	31.3	47 24.9	54	21 00.1	+100
3	103 50.2	245 21.5	43.1	272 48.0	23.1	19 55.0	46.1	251 53.6	31.4	61 49.3	52	+21 10.1	+ 98
4	118 52.6	260 20.9	44.1	287 49.1	23.7	34 57.7	46.1	266 55.8	31.5	76 13.5	53	21 19.9	+ 96
5	133 55.1	275 20.4	45.2	302 50.1	24.3	50 00.5	46.1	281 58.0	31.6	90 37.8	51	21 29.5	+ 95
6	148 57.5	290 19.8	−13 46.2	317 51.2	− 3 24.9	65 03.2	+22 46.1	297 00.2	−10 31.6	105 01.9	51	+21 39.0	+ 94
7	164 00.0	305 19.2	47.2	332 52.2	25.5	80 06.0	46.1	312 02.4	31.7	119 26.0	50	21 48.4	+ 92
8	179 02.5	320 18.6	48.3	347 53.3	26.1	95 08.8	46.0	327 04.6	31.8	133 50.0	49	21 57.6	+ 90
9	194 04.9	335 18.0	49.3	2 54.3	26.7	110 11.5	46.0	342 06.8	31.9	148 13.9	49	+22 06.6	+ 89
10	209 07.4	350 17.5	50.3	17 55.4	27.3	125 14.3	46.0	357 08.9	32.0	162 37.8	48	22 15.5	+ 87
11	224 09.9	5 16.9	51.4	32 56.4	27.9	140 17.0	46.0	12 11.1	32.1	177 01.6	48	22 24.2	+ 86
12	239 12.3	20 16.3	−13 52.4	47 57.5	− 3 28.5	155 19.8	+22 46.0	27 13.3	−10 32.2	191 25.4	47	+22 32.8	+ 84
13	254 14.8	35 15.7	53.4	62 58.5	29.1	170 22.6	46.0	42 15.5	32.3	205 49.1	46	22 41.2	+ 82
14	269 17.3	50 15.1	54.4	77 59.5	29.7	185 25.3	46.0	57 17.7	32.4	220 12.7	46	22 49.4	+ 81
15	284 19.7	65 14.5	55.5	93 00.6	30.3	200 28.1	46.0	72 19.9	32.5	234 36.3	45	+22 57.5	+ 79
16	299 22.2	80 14.0	56.5	108 01.6	30.9	215 30.8	46.0	87 22.1	32.6	248 59.8	45	23 05.4	+ 78
17	314 24.7	95 13.4	57.5	123 02.7	31.5	230 33.6	46.0	102 24.3	32.7	263 23.3	44	23 13.2	+ 76
18	329 27.1	110 12.8	−13 58.5	138 03.7	− 3 32.1	245 36.4	+22 46.0	117 26.5	−10 32.8	277 46.7	44	+23 20.8	+ 74
19	344 29.6	125 12.2	13 59.6	153 04.8	32.7	260 39.1	46.0	132 28.7	32.9	292 10.1	43	23 28.2	+ 73
20	359 32.0	140 11.6	14 00.6	168 05.8	33.3	275 41.9	45.9	147 30.9	32.9	306 33.4	43	23 35.5	+ 71
21	14 34.5	155 11.0	01.6	183 06.9	33.9	290 44.7	45.9	162 33.0	33.0	320 56.7	42	+23 42.6	+ 69
22	29 37.0	170 10.4	02.6	198 07.9	34.5	305 47.4	45.9	177 35.2	33.1	335 19.9	42	23 49.5	+ 67
23	44 39.4	185 09.8	03.6	213 08.9	35.1	320 50.2	45.9	192 37.4	33.2	349 43.1	42	23 56.2	+ 66
24	59 41.9	200 09.3	−14 04.7	228 10.0	− 3 35.7	335 53.0	+22 45.9	207 39.6	−10 33.3	4 06.3	41	+24 02.8	+ 64
code	—	− 6	− 10	+ 10	− 6	+ 27	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
18 h 0	183 43.5	−19 06.5
1	198 43.3	07.1
2	213 43.2	07.7
3	228 43.1	08.3
4	243 43.0	08.9
5	258 42.8	09.5
6	273 42.7	−19 10.1
7	288 42.6	10.7
8	303 42.5	11.3
9	318 42.3	11.9
10	333 42.2	12.5
11	348 42.1	13.1
12	3 41.9	−19 13.7
13	18 41.8	14.3
14	33 41.7	14.9
15	48 41.5	15.5
16	63 41.4	16.1
17	78 41.3	16.7
18	93 41.1	−19 17.2
19	108 41.0	17.8
20	123 40.9	18.4
21	138 40.7	19.0
22	153 40.6	19.6
23	168 40.5	20.2
19 0	183 40.3	−19 20.8
1	198 40.2	21.4
2	213 40.1	22.0
3	228 39.9	22.6
4	243 39.8	23.1
5	258 39.7	23.7
6	273 39.5	−19 24.3
7	288 39.4	24.9
8	303 39.2	25.5
9	318 39.1	26.1
10	333 39.0	26.6
11	348 38.8	27.2
12	3 38.7	−19 27.8
13	18 38.5	28.4
14	33 38.4	29.0
15	48 38.3	29.6
16	63 38.1	30.1
17	78 38.0	30.7
18	93 37.8	−19 31.3
19	108 37.7	31.9
20	123 37.6	32.4
21	138 37.4	33.0
22	153 37.3	33.6
23	168 37.1	34.2
20 0	183 37.0	−19 34.8
1	198 36.8	35.3
2	213 36.7	35.9
3	228 36.6	36.5
4	243 36.4	37.0
5	258 36.3	37.6
6	273 36.1	−19 38.2
7	288 36.0	38.8
8	303 35.8	39.3
9	318 35.7	39.9
10	333 35.5	40.5
11	348 35.4	41.0
12	3 35.2	−19 41.6
13	18 35.1	42.2
14	33 34.9	42.7
15	48 34.8	43.3
16	63 34.6	43.9
17	78 34.5	44.4
18	93 34.3	−19 45.0
19	108 34.2	45.6
20	123 34.0	46.1
21	138 33.9	46.7
22	153 33.7	47.2
23	168 33.6	47.8
24	183 33.4	−19 48.4
code	–	– 6

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.2	−57 28.2
30	Acrux	174 00.0	−62 50.5
19	Adhara	255 47.4	−28 54.3
10	Aldebaran	291 40.4	+16 25.2
32	Alioth	167 00.1	+56 12.3
34	Alkaid	153 34.3	+49 32.4
55	Al Na'ir	28 39.6	−47 11.3
15	Alnilam	276 31.4	− 1 13.6
25	Alphard	218 40.0	− 8 27.4
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.8	+19 25.2
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.2	−59 21.3
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.4	+ 7 24.1
17	Canopus	264 15.6	−52 39.9
12	Capella	281 40.1	+45 57.3
53	Deneb	50 02.2	+45 07.2
28	Denebola	183 19.3	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.4	+61 59.7
14	Elnath	279 08.8	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.1
31	Gacrux	172 51.3	−56 51.1
29	Gienah	176 38.5	−17 17.1
35	Hadar	149 52.2	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.5
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.8	−36 08.6
24	Miapl'dus	221 49.4	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.7	−56 53.3
21	Pollux	244 22.1	+28 08.3
20	Procyon	245 46.3	+ 5 20.7
46	R'alhague	96 48.2	+12 35.6
26	Regulus	208 31.0	+12 11.6
11	Rigel	281 54.7	− 8 15.0
38	Rigil Kent.	140 53.7	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.4
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.8	−16 38.9
33	Spica	159 18.7	−10 55.3
23	Suhail	223 25.3	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 18	19	20
h	m s	m s	m s
0	+14 54.2	+14 41.6	+14 28.2
6	+14 51.1	+14 38.3	+14 24.8
12	+14 48.0	+14 35.0	+14 21.3
18	+14 44.8	+14 31.7	+14 17.7
24	+14 41.6	+14 28.2	+14 14.1

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 18 h m	19 h m	20 h m	21 h m
72	▬	5 49	12 22	10 28	▭	▭
70	10 17	5 45	12 45	11 57	▭	▭
68	9 31	5 42	13 04	12 37	▭	▭
66	9 02	5 40	13 18	13 05	12 43	▭
64	8 40	5 37	13 31	13 27	13 24	13 22
62	8 22	5 35	13 41	13 45	13 52	14 11
60	8 07	5 34	13 50	13 59	14 14	14 42
58	7 55	5 32	13 58	14 12	14 32	15 06
56	7 44	5 29	14 05	14 23	14 47	15 25
54	7 35	5 27	14 12	14 32	15 00	15 41
52	7 26	5 26	14 17	14 41	15 12	15 55
50	7 19	5 23	14 23	14 48	15 22	16 07
45	7 03	5 18	14 34	15 05	15 44	16 32
40	6 50	5 14	14 43	15 19	16 01	16 52
35	6 38	5 09	14 51	15 30	16 16	17 09
30	6 28	5 04	14 58	15 41	16 29	17 24
20	6 11	4 53	15 11	15 58	16 51	17 48
10	5 56	4 43	15 22	16 14	17 10	18 10
0	5 42	4 29	15 32	16 29	17 28	18 30
10	5 28	4 13	15 43	16 44	17 47	18 50
20	5 12	3 51	15 54	16 59	18 06	19 12
30	4 54	3 24	16 07	17 18	18 29	19 37
35	4 44	3 05	16 15	17 29	18 42	19 52
40	4 32	2 41	16 23	17 41	18 58	20 09
45	4 18	2 09	16 34	17 56	19 16	20 30
50	4 00	1 14	16 46	18 14	19 39	20 57
52	3 52	0 30	16 52	18 23	19 51	21 09
54	3 43	////	16 58	18 32	20 03	21 24
56	3 32	////	17 06	18 43	20 18	21 41
58	3 20	////	17 14	18 56	20 35	22 02
60 S	3 06	////	17 23	19 10	20 56	22 28

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 18 h m	19 h m	20 h m	21 h m
72	▬	17 38	5 45	9 38	▭	▭
70	13 13	17 42	5 24	8 09	▭	▭
68	13 59	17 45	5 08	7 30	▭	▭
66	14 28	17 47	4 55	7 03	9 29	▭
64	14 51	17 51	4 44	6 43	8 49	10 59
62	15 08	17 52	4 35	6 27	8 21	10 11
60	15 23	17 55	4 27	6 13	8 00	9 40
58	15 35	17 57	4 21	6 01	7 42	9 17
56	15 46	17 59	4 15	5 51	7 28	8 58
54	15 55	18 01	4 09	5 42	7 15	8 42
52	16 04	18 04	4 05	5 35	7 04	8 29
50	16 11	18 05	4 00	5 28	6 55	8 17
45	16 28	18 11	3 51	5 12	6 34	7 52
40	16 41	18 15	3 43	5 00	6 18	7 32
35	16 52	18 20	3 37	4 50	6 04	7 16
30	17 02	18 25	3 31	4 41	5 52	7 02
20	17 20	18 37	3 21	4 25	5 31	6 38
10	17 35	18 49	3 12	4 11	5 13	6 17
0	17 49	19 02	3 04	3 59	4 57	5 58
10	18 03	19 18	2 56	3 46	4 40	5 38
20	18 19	19 40	2 47	3 32	4 22	5 18
30	18 37	20 08	2 37	3 17	4 02	4 54
35	18 47	20 27	2 32	3 08	3 50	4 40
40	19 00	20 52	2 25	2 58	3 37	4 24
45	19 14	21 25	2 18	2 47	3 21	4 04
50	19 32	22 22	2 09	2 32	3 02	3 40
52	19 40	23 09	2 05	2 26	2 52	3 29
54	19 49	////	2 01	2 18	2 42	3 16
56	20 00	////	1 56	2 10	2 30	3 01
58	20 12	////	1 50	2 01	2 17	2 43
60 S	20 26	////	1 44	1 51	2 02	2 21

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
18	21 45	10 37	8 52	1 49	10 18
19	22 43	10 38	8 50	1 45	10 15
20	23 43	10 39	8 48	1 41	10 11
21	24 45	10 40	8 47	1 36	10 08

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	18 ′	19 ′	20 ′
0	20.0	20.0	19.6
4	20.0	20.0	19.6
8	20.0	20.0	19.6
12	19.9	19.9	19.5
16	19.8	19.8	19.5
20	19.8	19.8	19.4
24	19.6	19.6	19.3
28	19.5	19.5	19.2
32	19.4	19.4	19.1
36	19.3	19.3	18.9
40	19.1	19.1	18.8
44	18.9	18.9	18.6
48	18.8	18.8	18.5
52	18.6	18.6	18.3
56	18.4	18.4	18.1
60	18.1	18.1	17.9
64	17.9	17.9	17.7
68	17.7	17.7	17.5
72	17.5	17.5	17.3
76	17.2	17.2	17.1
80	17.0	17.0	16.9
84	16.7	16.7	16.6
88	16.6	16.6	16.5
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	18 ′	19 ′	20 ′
0	13.0	13.0	13.2
4	13.0	13.0	13.2
8	13.1	13.1	13.3
12	13.1	13.1	13.3
16	13.2	13.2	13.4
20	13.3	13.3	13.5
24	13.4	13.4	13.5
28	13.5	13.5	13.6
32	13.6	13.6	13.8
36	13.7	13.7	13.9
40	13.9	13.9	14.0
44	14.1	14.1	14.2
48	14.3	14.3	14.4
52	14.4	14.4	14.5
56	14.6	14.6	14.7
60	14.9	14.9	14.9
64	15.1	15.1	15.1
68	15.3	15.3	15.3
72	15.5	15.5	15.5
76	15.8	15.8	15.8
80	16.0	16.0	16.0
84	16.3	16.3	16.2
88	16.4	16.4	16.4
90			

Subtract from table, back cover

Full Moon 20

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.9 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
21 0	59 41.9	200 09.3	−14 04.7	228 10.0	− 3 35.7	335 53.0	+22 45.9	207 39.6	−10 33.3	4 06.3	41	+24 02.8	+ 64
1	74 44.4	215 08.7	05.7	243 11.0	36.3	350 55.7	45.9	222 41.8	33.4	18 29.4	41	24 09.2	+ 63
2	89 46.8	230 08.1	06.7	258 12.1	36.9	5 58.5	45.9	237 44.0	33.5	32 52.5	40	24 15.5	+ 60
3	104 49.3	245 07.5	•• 07.7	273 13.1	•• 37.5	21 01.2	•• 45.9	252 46.2	•• 33.6	47 15.5	41	•24 21.5	+ 59
4	119 51.8	260 06.9	08.7	288 14.2	38.1	36 04.0	45.9	267 48.4	33.7	61 38.6	39	24 27.4	+ 57
5	134 54.2	275 06.3	09.8	303 15.2	38.7	51 06.8	45.9	282 50.6	33.8	76 01.5	40	24 33.1	+ 55
6	149 56.7	290 05.7	−14 10.8	318 16.3	− 3 39.3	66 09.5	+22 45.9	297 52.8	−10 33.9	90 24.5	39	+24 38.6	+ 54
7	164 59.1	305 05.1	11.8	333 17.3	39.9	81 12.3	45.9	312 55.0	34.0	104 47.4	39	24 44.0	+ 52
8	180 01.6	320 04.5	12.8	348 18.3	40.5	96 15.1	45.8	327 57.1	34.1	119 10.3	39	24 49.2	+ 50
9	195 04.1	335 03.9	•• 13.8	3 19.4	•• 41.1	111 17.8	•• 45.8	342 59.3	•• 34.1	133 33.2	39	•24 54.2	+ 48
10	210 06.5	350 03.3	14.8	18 20.4	41.7	126 20.6	45.8	358 01.5	34.2	147 56.1	38	24 59.0	+ 46
11	225 09.0	5 02.7	15.8	33 21.5	42.3	141 23.4	45.8	13 03.7	34.3	162 18.9	39	25 03.6	+ 45
12	240 11.5	20 02.1	−14 16.9	48 22.5	− 3 42.9	156 26.1	+22 45.8	28 05.9	−10 34.4	176 41.8	38	+25 08.1	+ 43
13	255 13.9	35 01.5	17.9	63 23.6	43.5	171 28.9	45.8	43 08.1	34.5	191 04.6	38	25 12.4	+ 41
14	270 16.4	50 01.0	18.9	78 24.6	44.2	186 31.7	45.8	58 10.3	34.6	205 27.4	38	25 16.5	+ 39
15	285 18.9	65 00.4	•• 19.9	93 25.7	•• 44.8	201 34.4	•• 45.8	73 12.5	•• 34.7	219 50.2	38	•25 20.4	+ 38
16	300 21.3	79 59.8	20.9	108 26.7	45.4	216 37.2	45.8	88 14.7	34.8	234 13.0	38	25 24.2	+ 35
17	315 23.8	94 59.2	21.9	123 27.7	46.0	231 40.0	45.8	103 16.9	34.9	248 35.8	38	25 27.7	+ 34
18	330 26.3	109 58.6	−14 22.9	138 28.8	− 3 46.6	246 42.8	+22 45.8	118 19.1	−10 35.0	262 58.6	38	+25 31.1	+ 32
19	345 28.7	124 58.0	23.9	153 29.8	47.2	261 45.5	45.7	133 21.3	35.1	277 21.4	37	25 34.3	+ 30
20	0 31.2	139 57.4	24.9	168 30.9	47.8	276 48.3	45.7	148 23.4	35.2	291 44.1	39	25 37.3	+ 28
21	15 33.6	154 56.8	•• 26.0	183 31.9	•• 48.4	291 51.1	•• 45.7	163 25.6	•• 35.3	306 07.0	38	•25 40.1	+ 27
22	30 36.1	169 56.2	27.0	198 33.0	49.0	306 53.8	45.7	178 27.8	35.3	320 29.8	38	25 42.8	+ 25
23	45 38.6	184 55.6	28.0	213 34.0	49.6	321 56.6	45.7	193 30.0	35.4	334 52.6	38	25 45.3	+ 22
22 0	60 41.0	199 55.0	−14 29.0	228 35.1	− 3 50.2	336 59.4	+22 45.7	208 32.2	−10 35.5	349 15.4	39	+25 47.5	+ 21
1	75 43.5	214 54.4	30.0	243 36.1	50.8	352 02.1	45.7	223 34.4	35.6	3 38.3	39	25 49.6	+ 20
2	90 46.0	229 53.8	31.0	258 37.1	51.4	7 04.9	45.7	238 36.6	35.7	18 01.2	38	25 51.6	+ 17
3	105 48.4	244 53.2	•• 32.0	273 38.2	•• 52.0	22 07.7	•• 45.7	253 38.8	•• 35.8	32 24.0	40	•25 53.3	+ 16
4	120 50.9	259 52.6	33.0	288 39.2	52.6	37 10.5	45.7	268 41.0	35.9	46 47.0	39	25 54.9	+ 14
5	135 53.4	274 51.9	34.0	303 40.3	53.2	52 13.2	45.7	283 43.2	36.0	61 09.9	40	25 56.3	+ 12
6	150 55.8	289 51.3	−14 35.0	318 41.3	− 3 53.8	67 16.0	+22 45.6	298 45.4	−10 36.1	75 32.9	40	+25 57.5	+ 10
7	165 58.3	304 50.7	36.0	333 42.4	54.4	82 18.8	45.6	313 47.6	36.2	89 55.9	40	25 58.5	+ 8
8	181 00.8	319 50.1	37.0	348 43.4	55.0	97 21.5	45.6	328 49.8	36.3	104 18.9	41	25 59.3	+ 7
9	196 03.2	334 49.5	•• 38.0	3 44.5	•• 55.6	112 24.3	•• 45.6	343 51.9	•• 36.4	118 42.0	41	•26 00.0	+ 5
10	211 05.7	349 48.9	39.0	18 45.5	56.2	127 27.1	45.6	358 54.1	36.5	133 05.1	41	26 00.5	+ 3
11	226 08.1	4 48.3	40.0	33 46.5	56.8	142 29.9	45.6	13 56.3	36.5	147 28.2	42	26 00.8	+ 1
12	241 10.6	19 47.7	−14 41.0	48 47.6	− 3 57.4	157 32.6	+22 45.6	28 58.5	−10 36.6	161 51.4	43	+26 00.9	0
13	256 13.1	34 47.1	42.0	63 48.6	58.0	172 35.4	45.6	44 00.7	36.7	176 14.7	42	26 00.9	− 3
14	271 15.5	49 46.5	43.0	78 49.7	58.6	187 38.2	45.6	59 02.9	36.8	190 37.9	44	26 00.6	− 4
15	286 18.0	64 45.9	•• 44.0	93 50.7	•• 59.2	202 40.9	•• 45.6	74 05.1	•• 36.9	205 01.3	44	•26 00.2	− 5
16	301 20.5	79 45.3	45.0	108 51.8	3 59.8	217 43.7	45.6	89 07.3	37.0	219 24.7	44	25 59.7	− 8
17	316 22.9	94 44.7	46.0	123 52.8	4 00.4	232 46.5	45.5	104 09.5	37.1	233 48.1	45	25 58.9	− 9
18	331 25.4	109 44.1	−14 47.0	138 53.9	− 4 01.0	247 49.3	+22 45.5	119 11.7	−10 37.2	248 11.6	45	+25 58.0	− 11
19	346 27.9	124 43.4	48.0	153 54.9	01.6	262 52.0	45.5	134 13.9	37.3	262 35.1	46	25 56.9	− 13
20	1 30.3	139 42.8	49.0	168 55.9	02.2	277 54.8	45.5	149 16.1	37.4	276 58.7	47	25 55.6	− 14
21	16 32.8	154 42.2	•• 50.0	183 57.0	•• 02.8	292 57.6	•• 45.5	164 18.3	•• 37.5	291 22.4	47	•25 54.2	− 16
22	31 35.3	169 41.6	50.9	198 58.0	03.4	308 00.4	45.5	179 20.5	37.5	305 46.1	49	25 52.6	− 18
23	46 37.7	184 41.0	51.9	213 59.1	04.0	323 03.1	45.5	194 22.6	37.6	320 10.0	48	25 50.8	− 20
23 0	61 40.2	199 40.4	−14 52.9	229 00.1	− 4 04.6	338 05.9	+22 45.5	209 24.8	−10 37.7	334 33.8	50	+25 48.8	− 21
1	76 42.6	214 39.8	53.9	244 01.2	05.2	353 08.7	45.5	224 27.0	37.8	348 57.8	50	25 46.7	− 23
2	91 45.1	229 39.2	54.9	259 02.2	05.8	8 11.5	45.5	239 29.2	37.9	3 21.8	51	25 44.4	− 24
3	106 47.6	244 38.5	•• 55.9	274 03.3	•• 06.4	23 14.2	•• 45.5	254 31.4	•• 38.0	17 45.9	51	•25 42.0	− 26
4	121 50.0	259 37.9	56.9	289 04.3	07.0	38 17.0	45.4	269 33.6	38.1	32 10.0	53	25 39.4	− 28
5	136 52.5	274 37.3	57.9	304 05.3	07.6	53 19.8	45.4	284 35.8	38.2	46 34.3	53	25 36.6	− 29
6	151 55.0	289 36.7	−14 58.9	319 06.4	− 4 08.2	68 22.6	+22 45.4	299 38.0	−10 38.3	60 58.6	54	+25 33.7	− 31
7	166 57.4	304 36.1	14 59.8	334 07.4	08.8	83 25.4	45.4	314 40.2	38.4	75 23.0	55	25 30.6	− 33
8	181 59.9	319 35.5	15 00.8	349 08.5	09.4	98 28.1	45.4	329 42.4	38.5	89 47.5	55	25 27.3	− 34
9	197 02.4	334 34.8	•• 01.8	4 09.5	•• 10.0	113 30.9	•• 45.4	344 44.6	•• 38.6	104 12.0	57	•25 23.9	− 36
10	212 04.8	349 34.2	02.8	19 10.6	10.6	128 33.7	45.4	359 46.8	38.6	118 36.7	57	25 20.3	− 37
11	227 07.3	4 33.6	03.8	34 11.6	11.2	143 36.5	45.4	14 49.0	38.7	133 01.4	58	25 16.6	− 39
12	242 09.8	19 33.0	−15 04.8	49 12.7	− 4 11.8	158 39.2	+22 45.4	29 51.2	−10 38.8	147 26.2	60	+25 12.7	− 40
13	257 12.2	34 32.4	05.7	64 13.7	12.4	173 42.0	45.4	44 53.4	38.9	161 51.2	60	25 08.7	− 42
14	272 14.7	49 31.8	06.7	79 14.7	12.9	188 44.8	45.4	59 55.6	39.0	176 16.2	61	25 04.5	− 43
15	287 17.1	64 31.1	•• 07.7	94 15.8	•• 13.5	203 47.6	•• 45.3	74 57.7	•• 39.1	190 41.3	62	•25 00.2	− 45
16	302 19.6	79 30.5	08.7	109 16.8	14.1	218 50.4	45.3	89 59.9	39.2	205 06.5	63	24 55.7	− 47
17	317 22.1	94 29.9	09.7	124 17.9	14.7	233 53.1	45.3	105 02.1	39.3	219 31.8	64	24 51.0	− 48
18	332 24.5	109 29.3	−15 10.6	139 18.9	− 4 15.3	248 55.9	+22 45.3	120 04.3	−10 39.4	233 57.2	64	+24 46.2	− 49
19	347 27.0	124 28.6	11.6	154 20.0	15.9	263 58.7	45.3	135 06.5	39.5	248 22.6	66	24 41.3	− 51
20	2 29.5	139 28.0	12.6	169 21.0	16.5	279 01.5	45.3	150 08.7	39.5	262 48.2	67	24 36.2	− 52
21	17 31.9	154 27.4	•• 13.6	184 22.1	•• 17.1	294 04.3	•• 45.3	165 10.9	•• 39.6	277 13.9	68	•24 31.0	− 53
22	32 34.4	169 26.8	14.6	199 23.1	17.7	309 07.0	45.3	180 13.1	39.7	291 39.7	69	24 25.7	− 55
23	47 36.9	184 26.2	15.5	214 24.1	18.3	324 09.8	45.3	195 15.3	39.8	306 05.6	70	24 20.2	− 57
24	62 39.3	199 25.5	−15 16.5	229 25.2	− 4 18.9	339 12.6	+22 45.3	210 17.5	−10 39.9	320 31.6	71	+24 14.5	− 58
code	—	− 6	− 10	+ 10	− 6	+ 28	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
21 h 0	183 33.4	−19 48.4
1	198 33.3	48.9
2	213 33.1	49.5
3	228 33.0	50.0
4	243 32.8	50.6
5	258 32.7	51.2
6	273 32.5	−19 51.7
7	288 32.4	52.3
8	303 32.2	52.8
9	318 32.1	53.4
10	333 31.9	53.9
11	348 31.7	54.5
12	3 31.6	−19 55.0
13	18 31.4	55.6
14	33 31.3	56.1
15	48 31.1	56.7
16	63 31.0	57.2
17	78 30.8	57.8
18	93 30.6	−19 58.3
19	108 30.5	58.9
20	123 30.3	19 59.4
21	138 30.2	−20 00.0
22	153 30.0	00.5
23	168 29.9	01.1
22 0	183 29.7	−20 01.6
1	198 29.5	02.2
2	213 29.4	02.7
3	228 29.2	03.2
4	243 29.0	03.8
5	258 28.9	04.3
6	273 28.7	−20 04.9
7	288 28.6	05.4
8	303 28.4	05.9
9	318 28.2	06.5
10	333 28.1	07.0
11	348 27.9	07.6
12	3 27.7	−20 08.1
13	18 27.6	08.6
14	33 27.4	09.2
15	48 27.2	09.7
16	63 27.1	10.2
17	78 26.9	10.8
18	93 26.8	−20 11.3
19	108 26.6	11.8
20	123 26.4	12.4
21	138 26.2	12.9
22	153 26.1	13.4
23	168 25.9	14.0
23 0	183 25.7	−20 14.5
1	198 25.6	15.0
2	213 25.4	15.5
3	228 25.2	16.1
4	243 25.1	16.6
5	258 24.9	17.1
6	273 24.7	−20 17.7
7	288 24.6	18.2
8	303 24.4	18.7
9	318 24.2	19.2
10	333 24.0	19.8
11	348 23.9	20.3
12	3 23.7	−20 20.8
13	18 23.5	21.3
14	33 23.3	21.8
15	48 23.2	22.4
16	63 23.0	22.9
17	78 22.8	23.4
18	93 22.7	−20 23.9
19	108 22.5	24.4
20	123 22.3	24.9
21	138 22.1	25.5
22	153 21.9	26.0
23	168 21.8	26.5
24	183 21.6	−20 27.0
code	—	− 5

No.	Name	SHA	Dec.
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.3	−57 28.2
30	Acrux	174 00.0	−62 50.5
19	Adhara	255 47.4	−28 54.3
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	167 00.0	+56 12.3
34	Alkaid	153 34.3	+49 32.4
55	Al Na'ir	28 39.6	−47 11.3
15	Alnilam	276 31.4	− 1 13.6
25	Alphard	218 39.9	− 8 27.4
41	Alphecca	126 49.2	+26 52.1
1	Alpheratz	358 29.6	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.2	−59 21.3
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.4	+ 7 24.1
17	Canopus	264 15.5	−52 39.9
12	Capella	281 40.1	+45 57.3
53	Deneb	50 02.2	+45 07.2
28	Denebola	183 19.3	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.3	+61 59.7
14	Elnath	279 08.8	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.0	−29 52.1
31	Gacrux	172 51.3	−56 51.1
29	Gienah	176 38.5	−17 17.1
35	Hadar	149 52.1	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.4
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.3	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.7	−56 53.3
21	Pollux	244 22.1	+28 08.3
20	Procyon	245 46.2	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 31.0	+12 11.5
11	Rigel	281 54.7	− 8 15.0
38	Rigil Kent.	140 53.7	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.3	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.8	−16 38.9
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.3	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 21	22	23
h	m s	m s	m s
0	+14 14.1	+13 59.1	+13 43.3
6	+14 10.4	+13 55.2	+13 39.2
12	+14 06.7	+13 51.3	+13 35.1
18	+14 02.9	+13 47.3	+13 30.9
24	+13 59.1	+13 43.3	+13 26.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 21 h m	22 h m	23 h m	24 h m
72	▬	5 58	▭	▭	▭	▭
70	10 43	5 54	▭	▭	▭	▭
68	9 46	5 50	▭	▭	▭	▭
66	9 13	5 47	▭	▭	▭	16 49
64	8 49	5 44	13 22	13 42	15 33	17 31
62	8 30	5 41	14 11	14 57	16 20	17 59
60	8 15	5 39	14 42	15 33	16 50	18 21
58	8 02	5 36	15 06	15 59	17 13	18 38
56	7 50	5 34	15 25	16 20	17 31	18 53
54	7 40	5 31	15 41	16 37	17 47	19 06
52	7 31	5 30	15 55	16 51	18 01	19 17
50	7 24	5 27	16 07	17 04	18 12	19 27
45	7 07	5 22	16 32	17 30	18 37	19 47
40	6 53	5 17	16 52	17 51	18 56	20 04
35	6 41	5 12	17 09	18 09	19 13	20 18
30	6 31	5 07	17 24	18 24	19 27	20 30
20	6 13	4 55	17 48	18 49	19 51	20 51
10	5 57	4 43	18 10	19 11	20 11	21 09
0	5 43	4 29	18 30	19 32	20 31	21 25
10	5 28	4 12	18 50	19 52	20 50	21 42
20	5 12	3 51	19 12	20 14	21 10	22 00
30	4 53	3 21	19 37	20 40	21 34	22 20
35	4 42	3 02	19 52	20 55	21 48	22 32
40	4 30	2 37	20 09	21 12	22 04	22 46
45	4 15	2 03	20 30	21 33	22 23	23 02
50	3 57	1 02	20 57	21 59	22 47	23 21
52	3 48	////	21 09	22 12	22 58	23 31
54	3 38	////	21 24	22 27	23 11	23 41
56	3 27	////	21 41	22 44	23 26	23 53
58	3 15	////	22 02	23 05	23 44	24 07
60	3 00	////	22 28	23 31	24 05	0 05
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 21 h m	22 h m	23 h m	24 h m
72	▬	17 30	▭	▭	▭	▭
70	12 48	17 35	▭	▭	▭	▭
68	13 45	17 39	▭	▭	▭	▭
66	14 19	17 43	▭	▭	▭	13 45
64	14 43	17 46	10 59	12 50	13 05	13 03
62	15 02	17 49	10 11	11 34	12 17	12 34
60	15 17	17 51	9 40	10 58	11 46	12 12
58	15 30	17 53	9 17	10 32	11 23	11 54
56	15 42	17 57	8 58	10 12	11 04	11 38
54	15 52	17 59	8 42	9 55	10 48	11 25
52	16 00	18 00	8 29	9 40	10 35	11 14
50	16 08	18 03	8 17	9 27	10 23	11 03
45	16 25	18 08	7 52	9 01	9 58	10 42
40	16 39	18 14	7 32	8 40	9 38	10 24
35	16 51	18 19	7 16	8 23	9 21	10 09
30	17 01	18 25	7 02	8 08	9 06	9 57
20	17 19	18 36	6 38	7 42	8 42	9 35
10	17 35	18 49	6 17	7 20	8 20	9 15
0	17 50	19 03	5 58	7 00	8 00	8 57
10	18 05	19 21	5 38	6 39	7 40	8 39
20	18 21	19 42	5 18	6 17	7 18	8 20
30	18 39	20 11	4 54	5 51	6 53	7 57
35	18 50	20 31	4 40	5 36	6 39	7 44
40	19 03	20 57	4 24	5 19	6 22	7 28
45	19 18	21 32	4 04	4 58	6 01	7 10
50	19 36	22 34	3 40	4 31	5 35	6 47
52	19 45	////	3 29	4 18	5 22	6 36
54	19 55	////	3 16	4 04	5 07	6 23
56	20 06	////	3 01	3 46	4 50	6 09
58	20 19	////	2 43	3 25	4 30	5 52
60	20 34	////	2 21	2 59	4 04	5 31
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
21	24 45	10 40	8 47	1 36	10 08
22	0 45	10 41	8 45	1 32	10 04
23	1 46	10 42	8 43	1 27	10 01
24	2 44	10 43	8 42	1 23	9 57

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	21 ′	22 ′	23 ′
0	19.0	18.1	17.1
4	19.0	18.1	17.1
8	18.9	18.1	17.1
12	18.9	18.0	17.0
16	18.9	18.0	17.0
20	18.8	18.0	17.0
24	18.7	17.9	17.0
28	18.6	17.8	16.9
32	18.5	17.8	16.9
36	18.4	17.7	16.8
40	18.3	17.6	16.8
44	18.2	17.5	16.7
48	18.0	17.4	16.6
52	17.9	17.3	16.6
56	17.7	17.2	16.5
60	17.6	17.0	16.4
64	17.4	16.9	16.4
68	17.2	16.8	16.3
72	17.0	16.6	16.2
76	16.8	16.5	16.1
80	16.7	16.4	16.0
84	16.5	16.2	16.0
88	16.3	16.1	15.9
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	21 ′	22 ′	23 ′
0	13.6	14.1	14.7
4	13.6	14.1	14.7
8	13.6	14.1	14.7
12	13.7	14.2	14.7
16	13.7	14.2	14.7
20	13.8	14.2	14.8
24	13.9	14.3	14.8
28	13.9	14.4	14.8
32	14.0	14.4	14.9
36	14.2	14.5	14.9
40	14.3	14.6	15.0
44	14.4	14.7	15.0
48	14.5	14.8	15.1
52	14.7	14.9	15.2
56	14.9	15.0	15.2
60	15.0	15.2	15.3
64	15.2	15.3	15.4
68	15.4	15.4	15.5
72	15.5	15.5	15.5
76	15.7	15.7	15.6
80	15.9	15.8	15.7
84	16.1	16.0	15.8
88	16.2	16.1	15.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	VENUS Dec.	MARS 1.8 GHA	MARS Dec.	JUPITER −2.3 GHA	JUPITER Dec.	SATURN 0.9 GHA	SATURN Dec.	MOON GHA	code	MOON Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
24 0	62 39.3	199 25.5	−15 16.5	229 25.2	− 4 18.9	339 12.6	+22 45.3	210 17.5	−10 39.9	320 31.6	71	+24 14.5	− 58
1	77 41.8	214 24.9	17.5	244 26.2	19.5	354 15.4	45.2	225 19.7	40.0	334 57.7	72	24 08.7	− 59
2	92 44.2	229 24.3	18.5	259 27.3	20.1	9 18.2	45.2	240 21.9	40.1	349 23.9	73	24 02.8	− 60
3	107 46.7	244 23.7	•• 19.4	274 28.3	•• 20.7	24 20.9	•• 45.2	255 24.1	•• 40.2	3 50.2	74	•23 56.8	− 62
4	122 49.2	259 23.0	20.4	289 29.4	21.3	39 23.7	45.2	270 26.3	40.3	18 16.6	75	23 50.6	− 63
5	137 51.6	274 22.4	21.4	304 30.4	21.9	54 26.5	45.2	285 28.5	40.4	32 43.1	76	23 44.3	− 64
6	152 54.1	289 21.8	−15 22.3	319 31.4	− 4 22.5	69 29.3	+22 45.2	300 30.7	−10 40.5	47 09.7	77	+23 37.9	− 66
7	167 56.6	304 21.1	23.3	334 32.5	23.1	84 32.1	45.2	315 32.9	40.5	61 36.4	79	23 31.3	− 67
8	182 59.0	319 20.5	24.3	349 33.5	23.7	99 34.9	45.2	330 35.1	40.6	76 03.3	79	23 24.6	− 68
9	198 01.5	334 19.9	•• 25.2	4 34.6	•• 24.3	114 37.6	•• 45.2	345 37.3	•• 40.7	90 30.2	81	•23 17.8	− 70
10	213 04.0	349 19.3	26.2	19 35.6	24.9	129 40.4	45.2	0 39.4	40.8	104 57.3	81	23 10.8	− 70
11	228 06.4	4 18.6	27.2	34 36.7	25.5	144 43.2	45.2	15 41.6	40.9	119 24.4	83	23 03.8	− 72
12	243 08.9	19 18.0	−15 28.1	49 37.7	− 4 26.1	159 46.0	+22 45.1	30 43.8	−10 41.0	133 51.7	84	+22 56.6	− 73
13	258 11.4	34 17.4	29.1	64 38.8	26.7	174 48.8	45.1	45 46.0	41.1	148 19.1	85	22 49.3	− 74
14	273 13.8	49 16.7	30.1	79 39.8	27.3	189 51.6	45.1	60 48.2	41.2	162 46.6	86	22 41.9	− 76
15	288 16.3	64 16.1	•• 31.0	94 40.8	•• 27.9	204 54.3	•• 45.1	75 50.4	•• 41.3	177 14.2	87	•22 34.3	− 76
16	303 18.7	79 15.5	32.0	109 41.9	28.5	219 57.1	45.1	90 52.6	41.4	191 41.9	89	22 26.7	− 78
17	318 21.2	94 14.8	33.0	124 42.9	29.1	234 59.9	45.1	105 54.8	41.4	206 09.8	89	22 18.9	− 79
18	333 23.7	109 14.2	−15 33.9	139 44.0	− 4 29.7	250 02.7	+22 45.1	120 57.0	−10 41.5	220 37.7	91	+22 11.0	− 80
19	348 26.1	124 13.6	34.9	154 45.0	30.3	265 05.5	45.1	135 59.2	41.6	235 05.8	91	22 03.0	− 81
20	3 28.6	139 12.9	35.9	169 46.1	30.9	280 08.3	45.1	151 01.4	41.7	249 33.9	93	21 54.9	− 82
21	18 31.1	154 12.3	•• 36.8	184 47.1	•• 31.5	295 11.0	•• 45.1	166 03.6	•• 41.8	264 02.2	94	•21 46.7	− 83
22	33 33.5	169 11.7	37.8	199 48.1	32.1	310 13.8	45.0	181 05.8	41.9	278 30.6	95	21 38.4	− 84
23	48 36.0	184 11.0	38.7	214 49.2	32.7	325 16.6	45.0	196 08.0	42.0	292 59.1	96	21 30.0	− 85
25 0	63 38.5	199 10.4	−15 39.7	229 50.2	− 4 33.3	340 19.4	+22 45.0	211 10.2	−10 42.1	307 27.7	97	+21 21.5	− 86
1	78 40.9	214 09.7	40.7	244 51.3	33.9	355 22.2	45.0	226 12.4	42.2	321 56.4	98	21 12.9	− 88
2	93 43.4	229 09.1	41.6	259 52.3	34.5	10 25.0	45.0	241 14.6	42.3	336 25.2	100	21 04.1	− 88
3	108 45.9	244 08.5	•• 42.6	274 53.4	•• 35.0	25 27.8	•• 45.0	256 16.8	•• 42.3	350 54.2	100	•20 55.3	− 89
4	123 48.3	259 07.8	43.5	289 54.4	35.6	40 30.5	45.0	271 19.0	42.4	5 23.2	102	20 46.4	− 90
5	138 50.8	274 07.2	44.5	304 55.5	36.2	55 33.3	45.0	286 21.2	42.5	19 52.4	103	20 37.4	− 91
6	153 53.2	289 06.5	−15 45.4	319 56.5	− 4 36.8	70 36.1	+22 45.0	301 23.4	−10 42.6	34 21.7	103	+20 28.3	− 92
7	168 55.7	304 05.9	46.4	334 57.5	37.4	85 38.9	45.0	316 25.6	42.7	48 51.0	105	20 19.1	− 93
8	183 58.2	319 05.3	47.3	349 58.6	38.0	100 41.7	44.9	331 27.8	42.8	63 20.5	106	20 09.8	− 94
9	199 00.6	334 04.6	•• 48.3	4 59.6	•• 38.6	115 44.5	•• 44.9	346 30.0	•• 42.9	77 50.1	107	•20 00.4	− 95
10	214 03.1	349 04.0	49.2	20 00.7	39.2	130 47.3	44.9	1 32.1	43.0	92 19.8	108	19 50.9	− 95
11	229 05.6	4 03.3	50.2	35 01.7	39.8	145 50.1	44.9	16 34.3	43.1	106 49.6	110	19 41.4	− 97
12	244 08.0	19 02.7	−15 51.1	50 02.8	− 4 40.4	160 52.9	+22 44.9	31 36.5	−10 43.2	121 19.6	110	+19 31.7	− 97
13	259 10.5	34 02.1	52.1	65 03.8	41.0	175 55.6	44.9	46 38.7	43.2	135 49.6	111	19 22.0	− 98
14	274 13.0	49 01.4	53.0	80 04.8	41.6	190 58.4	44.9	61 40.9	43.3	150 19.7	113	19 12.2	− 99
15	289 15.4	64 00.8	•• 54.0	95 05.9	•• 42.2	206 01.2	•• 44.9	76 43.1	•• 43.4	164 50.0	113	•19 02.3	−100
16	304 17.9	79 00.1	54.9	110 06.9	42.8	221 04.0	44.9	91 45.3	43.5	179 20.3	115	18 52.3	−100
17	319 20.4	93 59.5	55.9	125 08.0	43.4	236 06.8	44.9	106 47.5	43.6	193 50.8	115	18 42.3	−101
18	334 22.8	108 58.8	−15 56.8	140 09.0	− 4 44.0	251 09.6	+22 44.8	121 49.7	−10 43.7	208 21.3	117	+18 32.2	−103
19	349 25.3	123 58.2	57.8	155 10.1	44.6	266 12.4	44.8	136 51.9	43.8	222 52.0	117	18 21.9	−102
20	4 27.7	138 57.5	58.7	170 11.1	45.2	281 15.2	44.8	151 54.1	43.9	237 22.7	119	18 11.7	−104
21	19 30.2	153 56.9	•15 59.7	185 12.2	•• 45.8	296 18.0	•• 44.8	166 56.3	•• 44.0	251 53.6	119	•18 01.3	−104
22	34 32.7	168 56.2	16 00.6	200 13.2	46.4	311 20.7	44.8	181 58.5	44.0	266 24.5	121	17 50.9	−105
23	49 35.1	183 55.6	01.5	215 14.2	47.0	326 23.5	44.8	197 00.7	44.1	280 55.6	121	17 40.4	−106
26 0	64 37.6	198 54.9	−16 02.5	230 15.3	− 4 47.6	341 26.3	+22 44.8	212 02.9	−10 44.2	295 26.7	123	+17 29.8	−106
1	79 40.1	213 54.3	03.4	245 16.3	48.1	356 29.1	44.8	227 05.1	44.3	309 58.0	124	17 19.2	−107
2	94 42.5	228 53.6	04.4	260 17.4	48.7	11 31.9	44.8	242 07.3	44.4	324 29.4	124	17 08.5	−108
3	109 45.0	243 53.0	•• 05.3	275 18.4	•• 49.3	26 34.7	•• 44.7	257 09.5	•• 44.5	339 00.8	126	•16 57.7	−109
4	124 47.5	258 52.3	06.2	290 19.5	49.9	41 37.5	44.7	272 11.7	44.6	353 32.4	126	16 46.8	−109
5	139 49.9	273 51.7	07.2	305 20.5	50.5	56 40.3	44.7	287 13.9	44.7	8 04.0	127	16 35.9	−109
6	154 52.4	288 51.0	−16 08.1	320 21.5	− 4 51.1	71 43.1	+22 44.7	302 16.1	−10 44.8	22 35.7	129	+16 25.0	−110
7	169 54.8	303 50.4	09.1	335 22.6	51.7	86 45.9	44.7	317 18.3	44.8	37 07.6	129	16 14.0	−111
8	184 57.3	318 49.7	10.0	350 23.6	52.3	101 48.7	44.7	332 20.5	44.9	51 39.5	130	16 02.9	−112
9	199 59.8	333 49.1	•• 10.9	5 24.7	•• 52.9	116 51.4	•• 44.7	347 22.7	•• 45.0	66 11.5	131	•15 51.7	−112
10	215 02.2	348 48.4	11.9	20 25.7	53.5	131 54.2	44.7	2 24.9	45.1	80 43.6	132	15 40.5	−113
11	230 04.7	3 47.8	12.8	35 26.8	54.1	146 57.0	44.7	17 27.1	45.2	95 15.8	133	15 29.2	−113
12	245 07.2	18 47.1	−16 13.7	50 27.8	− 4 54.7	161 59.8	+22 44.7	32 29.3	−10 45.3	109 48.1	134	+15 17.9	−113
13	260 09.6	33 46.5	14.7	65 28.8	55.3	177 02.6	44.6	47 31.5	45.4	124 20.5	134	15 06.6	−115
14	275 12.1	48 45.8	15.6	80 29.9	55.9	192 05.4	44.6	62 33.7	45.5	138 52.9	136	14 55.1	−114
15	290 14.6	63 45.1	•• 16.5	95 30.9	•• 56.5	207 08.2	•• 44.6	77 35.9	•• 45.6	153 25.5	136	•14 43.7	−116
16	305 17.0	78 44.5	17.4	110 32.0	57.1	222 11.0	44.6	92 38.1	45.6	167 58.1	137	14 32.1	−116
17	320 19.5	93 43.8	18.4	125 33.0	57.7	237 13.8	44.6	107 40.3	45.7	182 30.8	138	14 20.5	−116
18	335 22.0	108 43.2	−16 19.3	140 34.1	− 4 58.2	252 16.6	+22 44.6	122 42.5	−10 45.8	197 03.6	139	+14 08.9	−117
19	350 24.4	123 42.5	20.2	155 35.1	58.8	267 19.4	44.6	137 44.7	45.9	211 36.5	139	13 57.2	−117
20	5 26.9	138 41.8	21.2	170 36.1	4 59.4	282 22.2	44.6	152 46.9	46.0	226 09.4	141	13 45.5	−118
21	20 29.3	153 41.2	•• 22.1	185 37.2	• 5 00.0	297 25.0	•• 44.6	167 49.1	•• 46.1	240 42.5	141	•13 33.7	−118
22	35 31.8	168 40.5	23.0	200 38.2	00.6	312 27.8	44.5	182 51.3	46.2	255 15.6	142	13 21.9	−118
23	50 34.3	183 39.9	23.9	215 39.3	01.2	327 30.6	44.5	197 53.5	46.3	269 48.8	143	13 10.1	−119
24	65 36.7	198 39.2	−16 24.9	230 40.3	− 5 01.8	342 33.4	+22 44.5	212 55.7	−10 46.3	284 22.1	143	+12 58.2	−120
code	−	− 6	− 10	+ 10	− 6	+ 27	0	+ 22	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
24 0	183 21.6	−20 27.0
1	198 21.4	27.5
2	213 21.2	28.0
3	228 21.1	28.5
4	243 20.9	29.1
5	258 20.7	29.6
6	273 20.5	−20 30.1
7	288 20.3	30.6
8	303 20.2	31.1
9	318 20.0	31.6
10	333 19.8	32.1
11	348 19.6	32.6
12	3 19.4	−20 33.1
13	18 19.3	33.6
14	33 19.1	34.1
15	48 18.9	34.6
16	63 18.7	35.1
17	78 18.5	35.6
18	93 18.4	−20 36.1
19	108 18.2	36.6
20	123 18.0	37.1
21	138 17.8	37.6
22	153 17.6	38.1
23	168 17.4	38.6
25 0	183 17.2	−20 39.1
1	198 17.1	39.6
2	213 16.9	40.1
3	228 16.7	40.6
4	243 16.5	41.1
5	258 16.3	41.6
6	273 16.1	−20 42.1
7	288 15.9	42.6
8	303 15.8	43.1
9	318 15.6	43.6
10	333 15.4	44.1
11	348 15.2	44.6
12	3 15.0	−20 45.1
13	18 14.8	45.6
14	33 14.6	46.0
15	48 14.4	46.5
16	63 14.2	47.0
17	78 14.0	47.5
18	93 13.9	−20 48.0
19	108 13.7	48.5
20	123 13.5	49.0
21	138 13.3	49.4
22	153 13.1	49.9
23	168 12.9	50.4
26 0	183 12.7	−20 50.9
1	198 12.5	51.4
2	213 12.3	51.9
3	228 12.1	52.3
4	243 11.9	52.8
5	258 11.7	53.3
6	273 11.5	−20 53.8
7	288 11.3	54.2
8	303 11.1	54.7
9	318 11.0	55.2
10	333 10.8	55.7
11	348 10.6	56.2
12	3 10.4	−20 56.6
13	18 10.2	57.1
14	33 10.0	57.6
15	48 09.8	58.0
16	63 09.6	58.5
17	78 09.4	59.0
18	93 09.2	−20 59.5
19	108 09.0	20 59.9
20	123 08.8	21 00.4
21	138 08.6	00.9
22	153 08.4	01.3
23	168 08.2	01.8
24	183 08.0	−21 02.3
code	—	− 5

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.3	−57 28.3
30	Acrux	173 59.9	−62 50.5
19	Adhara	255 47.4	−28 54.3
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	167 00.0	+56 12.3
34	Alkaid	153 34.3	+49 32.3
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.4	− 1 13.6
25	Alphard	218 39.9	− 8 27.4
41	Alphecca	126 49.2	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.3	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.1	−59 21.3
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.5	−52 39.9
12	Capella	281 40.0	+45 57.3
53	Deneb	50 02.2	+45 07.2
28	Denebola	183 19.3	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.3	+61 59.7
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.0	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.3	−56 51.1
29	Gienah	176 38.5	−17 17.1
35	Hadar	149 52.1	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.8	+74 20.4
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.3	−69 31.3
9	Mirfak	309 44.0	+49 42.1
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.7	−56 53.3
21	Pollux	244 22.0	+28 08.3
20	Procyon	245 46.2	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 31.0	+12 11.5
11	Rigel	281 54.7	− 8 15.1
38	Rigil Kent.	140 53.6	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.4	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.8	−16 38.9
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.3	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bi	137 55.3	−15 51.1

GMT	Equation of Time (App.—Mean) 24	25	26
h	m s	m s	m s
0	+13 26.7	+13 09.4	+12 51.2
6	+13 22.4	+13 04.9	+12 46.5
12	+13 18.1	+13 00.4	+12 41.8
18	+13 13.8	+12 55.8	+12 37.1
24	+13 09.4	+12 51.2	+12 32.3

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 24 h m	25 h m	26 h m	27 h m
72	▬	6 07	▭	▭	19 40	21 53
70	11 27	6 01	▭	17 39	20 09	22 06
68	10 02	5 57	▭	18 27	20 30	22 16
66	9 24	5 54	16 49	18 57	20 46	22 25
64	8 58	5 50	17 31	19 20	21 00	22 32
62	8 38	5 47	17 59	19 38	21 11	22 39
60	8 22	5 44	18 21	19 52	21 21	22 44
58	8 08	5 42	18 38	20 05	21 29	22 49
56	7 56	5 39	18 53	20 16	21 36	22 53
54	7 46	5 36	19 06	20 25	21 43	22 57
52	7 36	5 34	19 17	20 34	21 48	23 00
50	7 28	5 32	19 27	20 41	21 54	23 03
45	7 10	5 25	19 47	20 57	22 05	23 10
40	6 56	5 20	20 04	21 10	22 14	23 15
35	6 44	5 14	20 18	21 21	22 22	23 20
30	6 33	5 08	20 30	21 31	22 29	23 24
20	6 15	4 57	20 51	21 48	22 41	23 32
10	5 59	4 44	21 09	22 02	22 52	23 38
0	5 43	4 29	21 25	22 15	23 01	23 44
10	5 28	4 12	21 42	22 29	23 11	23 50
20	5 12	3 50	22 00	22 43	23 21	23 56
30	4 52	3 20	22 20	22 59	23 33	24 03
35	4 41	2 59	22 32	23 09	23 40	24 07
40	4 28	2 34	22 46	23 19	23 48	24 12
45	4 13	1 57	23 02	23 32	23 56	24 17
50	3 54	0 51	23 21	23 47	24 07	0 07
52	3 45	////	23 31	23 54	24 12	0 12
54	3 34	////	23 41	24 02	0 02	0 17
56	3 23	////	23 53	24 11	0 11	0 23
58	3 10	////	24 07	0 07	0 21	0 30
60	2 54	////	0 05	0 22	0 32	0 38
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 24 h m	25 h m	26 h m	27 h m
72	▬	17 23	▭	▭	14 22	13 39
70	12 07	17 30	▭	14 43	13 51	13 24
68	13 32	17 34	▭	13 55	13 29	13 11
66	14 09	17 38	13 45	13 23	13 11	13 01
64	14 35	17 41	13 03	13 00	12 56	12 52
62	14 55	17 44	12 34	12 41	12 44	12 44
60	15 12	17 48	12 12	12 25	12 33	12 38
58	15 26	17 51	11 54	12 12	12 24	12 32
56	15 38	17 54	11 38	12 01	12 16	12 27
54	15 48	17 56	11 25	11 50	12 08	12 22
52	15 57	17 58	11 14	11 42	12 02	12 18
50	16 06	18 02	11 03	11 33	11 56	12 14
45	16 23	18 07	10 42	11 16	11 43	12 06
40	16 38	18 13	10 24	11 02	11 33	11 59
35	16 50	18 19	10 09	10 50	11 24	11 53
30	17 01	18 25	9 57	10 39	11 16	11 47
20	17 19	18 36	9 35	10 21	11 02	11 38
10	17 35	18 49	9 15	10 05	10 49	11 30
0	17 51	19 05	8 57	9 50	10 38	11 22
10	18 06	19 22	8 39	9 35	10 26	11 14
20	18 23	19 45	8 20	9 18	10 14	11 06
30	18 42	20 15	7 57	9 00	9 59	10 56
35	18 54	20 36	7 44	8 48	9 51	10 50
40	19 07	21 02	7 28	8 36	9 41	10 44
45	19 22	21 39	7 10	8 21	9 30	10 36
50	19 41	22 50	6 47	8 02	9 16	10 27
52	19 50	////	6 36	7 53	9 10	10 23
54	20 01	////	6 23	7 43	9 02	10 19
56	20 12	////	6 09	7 32	8 54	10 13
58	20 26	////	5 52	7 19	8 45	10 08
60	20 42	////	5 31	7 04	8 35	10 01
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
24	2 44	10 43	8 42	1 23	9 57
25	3 38	10 44	8 40	1 19	9 54
26	4 27	10 45	8 38	1 14	9 50
27	5 12	10 46	8 37	1 10	9 47

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	24	25	26
°	′	′	′
0	15.9	14.8	13.9
4	15.9	14.8	13.9
8	15.9	14.8	13.9
12	15.9	14.8	13.9
16	15.9	14.8	14.0
20	15.9	14.8	14.0
24	15.9	14.8	14.0
28	15.9	14.9	14.1
32	15.9	14.9	14.1
36	15.9	14.9	14.2
40	15.9	14.9	14.2
44	15.8	15.0	14.3
48	15.8	15.0	14.4
52	15.8	15.0	14.4
56	15.8	15.1	14.5
60	15.8	15.1	14.6
64	15.8	15.1	14.7
68	15.7	15.2	14.8
72	15.7	15.2	14.8
76	15.7	15.3	14.9
80	15.7	15.3	15.0
84	15.7	15.3	15.1
88	15.6	15.4	15.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	24	25	26
°	′	′	′
0	15.3	16.0	16.5
4	15.3	16.0	16.5
8	15.3	16.0	16.5
12	15.3	16.0	16.5
16	15.3	16.0	16.4
20	15.4	15.9	16.4
24	15.4	15.9	16.4
28	15.4	15.9	16.3
32	15.4	15.9	16.3
36	15.4	15.9	16.2
40	15.4	15.8	16.2
44	15.4	15.8	16.1
48	15.4	15.8	16.0
52	15.5	15.7	16.0
56	15.5	15.7	15.9
60	15.5	15.7	15.8
64	15.5	15.6	15.7
68	15.5	15.6	15.6
72	15.5	15.6	15.6
76	15.6	15.5	15.5
80	15.6	15.5	15.4
84	15.6	15.4	15.3
88	15.6	15.4	15.2
90			

Subtract from table, back cover

Thanksgiving Day 26

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
27 0	65 36.7	198 39.2	−16 24.9	230 40.3	− 5 01.8	342 33.4	+22 44.5	212 55.7	−10 46.3	284 22.1	143	+12 58.2	−120
1	80 39.2	213 38.5	25.8	245 41.4	02.4	357 36.2	44.5	227 57.9	46.4	298 55.4	144	12 46.2	−120
2	95 41.7	228 37.9	26.7	260 42.4	03.0	12 39.0	44.5	243 00.1	46.5	313 28.8	145	12 34.2	−120
3	110 44.1	243 37.2	27.6	275 43.4	03.6	27 41.7	44.5	258 02.3	46.6	328 02.3	146	12 22.2	−121
4	125 46.6	258 36.5	28.6	290 44.5	04.2	42 44.5	44.5	273 04.5	46.7	342 35.9	146	12 10.1	−121
5	140 49.1	273 35.9	29.5	305 45.5	04.8	57 47.3	44.5	288 06.7	46.8	357 09.5	148	11 58.0	−121
6	155 51.5	288 35.2	−16 30.4	320 46.6	− 5 05.4	72 50.1	+22 44.5	303 08.9	−10 46.9	11 43.3	147	+11 45.9	−122
7	170 54.0	303 34.6	31.3	335 47.6	06.0	87 52.9	44.5	318 11.1	47.0	26 17.0	149	11 33.7	−122
8	185 56.5	318 33.9	32.2	350 48.7	06.5	102 55.7	44.4	333 13.3	47.1	40 50.9	149	11 21.5	−123
9	200 58.9	333 33.2	33.1	5 49.7	07.1	117 58.5	44.4	348 15.4	47.1	55 24.8	150	11 09.2	−123
10	216 01.4	348 32.6	34.1	20 50.7	07.7	133 01.3	44.4	3 17.6	47.2	69 58.8	150	10 56.9	−123
11	231 03.8	3 31.9	35.0	35 51.8	08.3	148 04.1	44.4	18 19.8	47.3	84 32.8	151	10 44.6	−123
12	246 06.3	18 31.2	−16 35.9	50 52.8	− 5 08.9	163 06.9	+22 44.4	33 22.0	−10 47.4	99 06.9	152	+10 32.3	−124
13	261 08.8	33 30.6	36.8	65 53.9	09.5	178 09.7	44.4	48 24.2	47.5	113 41.1	152	10 19.9	−124
14	276 11.2	48 29.9	37.7	80 54.9	10.1	193 12.5	44.4	63 26.4	47.6	128 15.3	153	10 07.5	−125
15	291 13.7	63 29.2	38.6	95 56.0	10.7	208 15.3	44.4	78 28.6	47.7	142 49.6	154	9 55.0	−124
16	306 16.2	78 28.5	39.5	110 57.0	11.3	223 18.1	44.4	93 30.8	47.8	157 24.0	154	9 42.6	−125
17	321 18.6	93 27.9	40.5	125 58.0	11.9	238 20.9	44.3	108 33.0	47.8	171 58.4	155	9 30.1	−126
18	336 21.1	108 27.2	−16 41.4	140 59.1	− 5 12.5	253 23.7	+22 44.3	123 35.2	−10 47.9	186 32.9	155	+ 9 17.5	−125
19	351 23.6	123 26.5	42.3	156 00.1	13.1	268 26.5	44.3	138 37.4	48.0	201 07.4	156	9 05.0	−126
20	6 26.0	138 25.9	43.2	171 01.2	13.6	283 29.3	44.3	153 39.6	48.1	215 42.0	156	8 52.4	−126
21	21 28.5	153 25.2	44.1	186 02.2	14.2	298 32.1	44.3	168 41.8	48.2	230 16.6	157	8 39.8	−126
22	36 31.0	168 24.5	45.0	201 03.3	14.8	313 34.9	44.3	183 44.0	48.3	244 51.3	157	8 27.2	−127
23	51 33.4	183 23.8	45.9	216 04.3	15.4	328 37.7	44.3	198 46.2	48.4	259 26.0	158	8 14.5	−126
28 0	66 35.9	198 23.2	−16 46.8	231 05.3	− 5 16.0	343 40.5	+22 44.3	213 48.4	−10 48.5	274 00.8	159	+ 8 01.9	−127
1	81 38.3	213 22.5	47.7	246 06.4	16.6	358 43.3	44.3	228 50.6	48.5	288 35.7	158	7 49.2	−127
2	96 40.8	228 21.8	48.6	261 07.4	17.2	13 46.1	44.2	243 52.8	48.6	303 10.5	160	7 36.5	−128
3	111 43.3	243 21.1	49.5	276 08.5	17.8	28 48.9	44.2	258 55.0	48.7	317 45.5	159	7 23.7	−127
4	126 45.7	258 20.5	50.4	291 09.5	18.4	43 51.7	44.2	273 57.2	48.8	332 20.4	161	7 11.0	−128
5	141 48.2	273 19.8	51.3	306 10.6	19.0	58 54.5	44.2	288 59.4	48.9	346 55.5	160	6 58.2	−128
6	156 50.7	288 19.1	−16 52.2	321 11.6	− 5 19.6	73 57.3	+22 44.2	304 01.6	−10 49.0	1 30.5	161	+ 6 45.4	−128
7	171 53.1	303 18.4	53.1	336 12.6	20.2	89 00.1	44.2	319 03.8	49.1	16 05.6	162	6 32.6	−128
8	186 55.6	318 17.7	54.0	351 13.7	20.7	104 02.9	44.2	334 06.0	49.2	30 40.8	162	6 19.8	−128
9	201 58.1	333 17.1	54.9	6 14.7	21.3	119 05.7	44.2	349 08.2	49.2	45 16.0	162	+ 6 07.0	−129
10	217 00.5	348 16.4	55.8	21 15.8	21.9	134 08.5	44.2	4 10.4	49.3	59 51.2	163	5 54.1	−129
11	232 03.0	3 15.7	56.7	36 16.8	22.5	149 11.3	44.1	19 12.7	49.4	74 26.5	163	5 41.2	−128
12	247 05.4	18 15.0	−16 57.6	51 17.9	− 5 23.1	164 14.1	+22 44.1	34 14.8	−10 49.5	89 01.8	163	+ 5 28.4	−129
13	262 07.9	33 14.3	58.5	66 18.9	23.7	179 16.9	44.1	49 17.1	49.6	103 37.1	164	5 15.5	−129
14	277 10.4	48 13.7	16 59.4	81 19.9	24.3	194 19.7	44.1	64 19.3	49.7	118 12.5	164	5 02.6	−129
15	292 12.8	63 13.0	−17 00.3	96 21.0	24.9	209 22.5	44.1	79 21.5	49.8	132 47.9	164	+ 4 49.7	−130
16	307 15.3	78 12.3	01.2	111 22.0	25.5	224 25.3	44.1	94 23.7	49.9	147 23.3	165	4 36.7	−129
17	322 17.8	93 11.6	02.1	126 23.1	26.1	239 28.1	44.1	109 25.9	49.9	161 58.8	165	4 23.8	−130
18	337 20.2	108 10.9	−17 03.0	141 24.1	− 5 26.6	254 30.9	+22 44.1	124 28.1	−10 50.0	176 34.3	165	+ 4 10.8	−129
19	352 22.7	123 10.2	03.9	156 25.1	27.2	269 33.7	44.1	139 30.3	50.1	191 09.8	165	3 57.9	−130
20	7 25.2	138 09.6	04.8	171 26.2	27.8	284 36.5	44.0	154 32.5	50.2	205 45.3	166	3 44.9	−129
21	22 27.6	153 08.9	05.7	186 27.2	28.4	299 39.3	44.0	169 34.7	50.3	220 20.9	166	+ 3 32.0	−130
22	37 30.1	168 08.2	06.5	201 28.3	29.0	314 42.1	44.0	184 36.9	50.4	234 56.5	166	3 19.0	−130
23	52 32.6	183 07.5	07.4	216 29.3	29.6	329 44.9	44.0	199 39.1	50.5	249 32.1	167	3 06.0	−130
29 0	67 35.0	198 06.8	−17 08.3	231 30.4	− 5 30.2	344 47.8	+22 44.0	214 41.3	−10 50.6	264 07.8	167	+ 2 53.0	−130
1	82 37.5	213 06.1	09.2	246 31.4	30.8	359 50.6	44.0	229 43.5	50.6	278 43.5	167	2 40.0	−130
2	97 39.9	228 05.4	10.1	261 32.4	31.4	14 53.4	44.0	244 45.7	50.7	293 19.2	167	2 27.0	−130
3	112 42.4	243 04.8	11.0	276 33.5	31.9	29 56.2	44.0	259 47.9	50.8	307 54.9	167	+ 2 14.0	−130
4	127 44.9	258 04.1	11.9	291 34.5	32.5	44 59.0	44.0	274 50.1	50.9	322 30.6	168	2 01.0	−130
5	142 47.3	273 03.4	12.8	306 35.6	33.1	60 01.8	43.9	289 52.3	51.0	337 06.4	167	1 48.0	−130
6	157 49.8	288 02.7	−17 13.6	321 36.6	− 5 33.7	75 04.6	+22 43.9	304 54.5	−10 51.1	351 42.1	168	+ 1 35.0	−130
7	172 52.3	303 02.0	14.5	336 37.7	34.3	90 07.4	43.9	319 56.7	51.2	6 17.9	168	1 22.0	−130
8	187 54.7	318 01.3	15.4	351 38.7	34.9	105 10.2	43.9	334 58.9	51.2	20 53.7	168	1 09.0	−130
9	202 57.2	333 00.6	16.3	6 39.7	35.5	120 13.0	43.9	350 01.1	51.3	35 29.5	168	+ 0 56.0	−130
10	217 59.7	347 59.9	17.2	21 40.8	36.1	135 15.8	43.9	5 03.3	51.4	50 05.3	168	0 43.0	−130
11	233 02.1	2 59.2	18.0	36 41.8	36.7	150 18.6	43.9	20 05.5	51.5	64 41.1	169	0 30.0	−130
12	248 04.6	17 58.5	−17 18.9	51 42.9	− 5 37.2	165 21.4	+22 43.9	35 07.7	−10 51.6	79 17.0	168	+ 0 17.0	−130
13	263 07.0	32 57.8	19.8	66 43.9	37.8	180 24.2	43.8	50 09.9	51.7	93 52.8	169	+ 0 04.0	−130
14	278 09.5	47 57.1	20.7	81 44.9	38.4	195 27.0	43.8	65 12.1	51.8	108 28.7	169	− 0 09.0	−130
15	293 12.0	62 56.5	21.5	96 46.0	39.0	210 29.8	43.8	80 14.3	51.8	123 04.6	168	+ 0 22.0	−130
16	308 14.4	77 55.8	22.4	111 47.0	39.6	225 32.6	43.8	95 16.5	51.9	137 40.4	169	0 35.0	−130
17	323 16.9	92 55.1	23.3	126 48.1	40.2	240 35.4	43.8	110 18.7	52.0	152 16.3	169	0 48.0	−130
18	338 19.4	107 54.4	−17 24.2	141 49.1	− 5 40.8	255 38.2	+22 43.8	125 20.9	−10 52.1	166 52.2	169	− 1 01.0	−129
19	353 21.8	122 53.7	25.0	156 50.2	41.4	270 41.1	43.8	140 23.1	52.2	181 28.1	168	1 13.9	−130
20	8 24.3	137 53.0	25.9	171 51.2	42.0	285 43.9	43.8	155 25.3	52.3	196 03.9	169	1 26.9	−130
21	23 26.8	152 52.3	26.8	186 52.2	42.5	300 46.7	43.8	170 27.5	52.4	210 39.8	169	+ 1 39.9	−129
22	38 29.2	167 51.6	27.6	201 53.3	43.1	315 49.5	43.7	185 29.7	52.5	225 15.7	169	1 52.8	−130
23	53 31.7	182 50.9	28.5	216 54.3	43.7	330 52.3	43.7	200 31.9	52.5	239 51.6	168	2 05.8	−129
24	68 34.2	197 50.2	−17 29.4	231 55.4	− 5 44.3	345 55.1	+22 43.7	215 34.1	−10 52.6	254 27.4	169	− 2 18.7	−129
code	−	− 7	− 9	+ 10	− 6	+ 28	0	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
27 0h	183 08.0	−21 02.3
1	198 07.8	02.7
2	213 07.6	03.2
3	228 07.4	03.7
4	243 07.2	04.1
5	258 07.0	04.6
6	273 06.8	−21 05.0
7	288 06.6	05.5
8	303 06.4	06.0
9	318 06.1	06.4
10	333 05.9	06.9
11	348 05.7	07.3
12	3 05.5	−21 07.8
13	18 05.3	08.3
14	33 05.1	08.7
15	48 04.9	09.2
16	63 04.7	09.6
17	78 04.5	10.1
18	93 04.3	−21 10.5
19	108 04.1	11.0
20	123 03.9	11.4
21	138 03.7	11.9
22	153 03.5	12.3
23	168 03.3	12.8
28 0	183 03.1	−21 13.2
1	198 02.8	13.7
2	213 02.6	14.1
3	228 02.4	14.6
4	243 02.2	15.0
5	258 02.0	15.5
6	273 01.8	−21 15.9
7	288 01.6	16.4
8	303 01.4	16.8
9	318 01.2	17.2
10	333 01.0	17.7
11	348 00.7	18.1
12	3 00.5	−21 18.6
13	18 00.3	19.0
14	33 00.1	19.4
15	47 59.9	19.9
16	62 59.7	20.3
17	77 59.5	20.8
18	92 59.2	−21 21.2
19	107 59.0	21.6
20	122 58.8	22.1
21	137 58.6	22.5
22	152 58.4	22.9
23	167 58.2	23.4
29 0	182 58.0	−21 23.8
1	197 57.7	24.2
2	212 57.5	24.7
3	227 57.3	25.1
4	242 57.1	25.5
5	257 56.9	26.0
6	272 56.6	−21 26.4
7	287 56.4	26.8
8	302 56.2	27.2
9	317 56.0	27.7
10	332 55.8	28.1
11	347 55.6	28.5
12	2 55.3	−21 28.9
13	17 55.1	29.4
14	32 54.9	29.8
15	47 54.7	30.2
16	62 54.5	30.6
17	77 54.2	31.0
18	92 54.0	−21 31.5
19	107 53.8	31.9
20	122 53.6	32.3
21	137 53.3	32.7
22	152 53.1	33.1
23	167 52.9	33.5
24	182 52.7	−21 34.0
code	—	- 4

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.7	−40 29.2
5	Achernar	335 59.3	−57 28.3
30	Acrux	173 59.9	−62 50.5
19	Adhara	255 47.3	−28 54.3
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	167 00.0	+56 12.3
34	Alkaid	153 34.3	+49 32.3
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.4	− 1 13.7
25	Alphard	218 39.9	− 8 27.4
41	Alphecca	126 49.2	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.1	−68 56.9
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.5	−52 40.0
12	Capella	281 40.0	+45 57.3
53	Deneb	50 02.2	+45 07.2
28	Denebola	183 19.2	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.2	+61 59.7
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.2	−56 51.1
29	Gienah	176 38.5	−17 17.1
35	Hadar	149 52.1	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.7	+74 20.4
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.2	−69 31.3
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.7	−56 53.3
21	Pollux	244 22.0	+28 08.3
20	Procyon	245 46.2	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.9	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.6	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.4	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.8	−16 38.9
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.2	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 27	28	29
h	m s	m s	m s
0	+12 32.3	+12 12.6	+11 52.2
6	+12 27.4	+12 07.6	+11 47.0
12	+12 22.6	+12 02.5	+11 41.8
18	+12 17.6	+11 57.4	+11 36.5
24	+12 12.6	+11 52.2	+11 31.1

Lat.	Sunrise	Twlt. begins	Moonrise 27	28	29	30
N °	h m	h m	h m	h m	h m	h m
72	▬	6 15	21 53	23 48	25 39	1 39
70	▬	6 10	22 06	23 52	25 35	1 35
68	10 18	6 04	22 16	23 56	25 32	1 32
66	9 35	6 00	22 25	23 58	25 29	1 29
64	9 07	5 56	22 32	24 01	0 01	1 27
62	8 46	5 52	22 39	24 03	0 03	1 25
60	8 28	5 49	22 44	24 04	0 04	1 23
58	8 14	5 46	22 49	24 06	0 06	1 22
56	8 01	5 43	22 53	24 07	0 07	1 21
54	7 51	5 40	22 57	24 09	0 09	1 19
52	7 41	5 37	23 00	24 10	0 10	1 18
50	7 32	5 35	23 03	24 11	0 11	1 17
45	7 14	5 29	23 10	24 13	0 13	1 15
40	6 59	5 22	23 15	24 15	0 15	1 13
35	6 47	5 17	23 20	24 16	0 16	1 12
30	6 36	5 11	23 24	24 18	0 18	1 10
20	6 17	4 58	23 32	24 20	0 20	1 08
10	6 00	4 46	23 38	24 23	0 23	1 06
0	5 44	4 30	23 44	24 25	0 25	1 04
10	5 29	4 12	23 50	24 27	0 27	1 02
20	5 12	3 50	23 56	24 29	0 29	1 01
30	4 52	3 19	24 03	0 03	0 31	0 58
35	4 40	2 57	24 07	0 07	0 33	0 57
40	4 27	2 31	24 12	0 12	0 34	0 56
45	4 11	1 52	24 17	0 17	0 36	0 54
50	3 51	0 36	0 07	0 24	0 38	0 52
52	3 42	////	0 12	0 26	0 39	0 51
54	3 31	////	0 17	0 30	0 40	0 50
56	3 19	////	0 23	0 33	0 42	0 49
58	3 05	////	0 30	0 37	0 43	0 48
60	2 49	////	0 38	0 41	0 45	0 47
S						

Lat.	Sunset	Twlt. ends	Moonset 27	28	29	30
N °	h m	h m	h m	h m	h m	h m
72	▬	17 18	13 39	13 10	12 44	12 19
70	▬	17 24	13 24	13 03	12 44	12 26
68	13 17	17 29	13 11	12 57	12 44	12 31
66	14 00	17 34	13 01	12 52	12 44	12 36
64	14 28	17 37	12 52	12 48	12 44	12 40
62	14 50	17 42	12 44	12 45	12 44	12 44
60	15 07	17 45	12 38	12 41	12 44	12 47
58	15 22	17 48	12 32	12 39	12 44	12 50
56	15 34	17 51	12 27	12 36	12 44	12 52
54	15 45	17 54	12 22	12 34	12 44	12 54
52	15 55	17 57	12 18	12 32	12 44	12 56
50	16 03	17 59	12 14	12 30	12 44	12 58
45	16 21	18 05	12 06	12 26	12 44	13 02
40	16 36	18 12	11 59	12 22	12 44	13 06
35	16 49	18 18	11 53	12 19	12 44	13 08
30	17 00	18 24	11 47	12 16	12 44	13 11
20	17 19	18 37	11 38	12 12	12 44	13 16
10	17 36	18 50	11 30	12 08	12 44	13 20
0	17 52	19 06	11 22	12 04	12 44	13 23
10	18 08	19 24	11 14	12 00	12 44	13 27
20	18 25	19 47	11 06	11 55	12 44	13 31
30	18 45	20 19	10 56	11 50	12 43	13 36
35	18 56	20 39	10 50	11 48	12 43	13 38
40	19 10	21 07	10 44	11 44	12 43	13 41
45	19 26	21 46	10 36	11 41	12 43	13 45
50	19 46	23 06	10 27	11 36	12 43	13 49
52	19 55	////	10 23	11 34	12 43	13 51
54	20 06	////	10 19	11 32	12 43	13 53
56	20 18	////	10 13	11 29	12 43	13 56
58	20 32	////	10 08	11 26	12 43	13 58
60	20 49	////	10 01	11 23	12 42	14 01
S						

GMT of Transit
Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
27	5 12	10 46	8 37	1 10	9 47
28	5 54	10 47	8 35	1 05	9 43
29	6 34	10 48	8 33	1 01	9 40
30	7 14	10 49	8 32	0 56	9 36

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.5	0.1	0.1
30	0.5	0.1	0.1
45	0.5	0.1	0.0
60	0.5	0.0	0.0
75	0.5	0.0	0.0
90			

Moon's Lower Limb
Add

Alt.	27	28	29
°	′	′	′
0	13.1	12.5	12.1
4	13.1	12.5	12.1
8	13.2	12.5	12.2
12	13.2	12.6	12.2
16	13.2	12.6	12.2
20	13.3	12.7	12.3
24	13.3	12.7	12.4
28	13.4	12.8	12.5
32	13.5	12.9	12.6
36	13.5	13.0	12.7
40	13.6	13.1	12.8
44	13.7	13.2	12.9
48	13.8	13.4	13.1
52	13.9	13.5	13.2
56	14.0	13.6	13.4
60	14.1	13.8	13.5
64	14.3	13.9	13.7
68	14.4	14.1	13.9
72	14.5	14.2	14.1
76	14.6	14.4	14.3
80	14.8	14.6	14.4
84	14.9	14.7	14.6
88	15.0	14.9	14.8
90			

Add to table, back cover

Moon's Upper Limb
Subtract

Alt.	27	28	29
°	′	′	′
0	16.9	17.3	17.5
4	16.9	17.3	17.5
8	16.9	17.3	17.5
12	16.9	17.2	17.4
16	16.8	17.2	17.4
20	16.8	17.1	17.3
24	16.7	17.1	17.2
28	16.7	17.0	17.2
32	16.6	16.9	17.1
36	16.5	16.8	16.9
40	16.4	16.7	16.8
44	16.4	16.6	16.7
48	16.3	16.4	16.6
52	16.2	16.3	16.4
56	16.0	16.2	16.2
60	15.9	16.0	16.1
64	15.8	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.3	15.2	15.2
84	15.2	15.1	15.0
88	15.1	14.9	14.9
90			

Subtract from table, back cover

Last Quarter 28

First Sunday in Advent 29

918768°—52——15

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
30 0	68 34.2	197 50.2	−17 29.4	231 55.4	− 5 44.3	345 55.1	+22 43.7	215 34.1	−10 52.6	254 27.4	169	− 2 18.7	−129
1	83 36.6	212 49.5	30.3	246 56.4	44.9	0 57.9	43.7	230 36.3	52.7	269 03.3	169	2 31.6	−129
2	98 39.1	227 48.8	31.1	261 57.4	45.5	16 00.7	43.7	245 38.5	52.8	283 39.2	168	2 44.5	−129
3	113 41.5	242 48.1	·· 32.0	276 58.5	·· 46.1	31 03.5	·· 43.7	260 40.7	·· 52.9	298 15.0	169	• 2 57.4	−129
4	128 44.0	257 47.4	32.8	291 59.5	46.7	46 06.3	43.7	275 42.9	53.0	312 50.9	168	3 10.3	−129
5	143 46.5	272 46.7	33.7	307 00.6	47.2	61 09.1	43.7	290 45.1	53.1	327 26.7	168	3 23.2	−128
6	158 48.9	287 46.0	−17 34.6	322 01.6	− 5 47.8	76 11.9	+22 43.6	305 47.3	−10 53.1	342 02.5	169	− 3 36.0	−129
7	173 51.4	302 45.3	35.4	337 02.7	48.4	91 14.7	43.6	320 49.5	53.2	356 38.4	168	3 48.9	−128
8	188 53.9	317 44.6	36.3	352 03.7	49.0	106 17.6	43.6	335 51.8	53.3	11 14.2	168	4 01.7	−128
9	203 56.3	332 43.9	·· 37.2	7 04.7	·· 49.6	121 20.4	·· 43.6	350 54.0	·· 53.4	25 50.0	167	• 4 14.5	−128
10	218 58.8	347 43.2	38.0	22 05.8	50.2	136 23.2	43.6	5 56.2	53.5	40 25.7	168	4 27.3	−128
11	234 01.3	2 42.4	38.9	37 06.8	50.8	151 26.0	43.6	20 58.4	53.6	55 01.5	168	4 40.1	−128
12	249 03.7	17 41.7	−17 39.7	52 07.9	− 5 51.3	166 28.8	+22 43.6	36 00.6	−10 53.7	69 37.3	167	− 4 52.9	−127
13	264 06.2	32 41.0	40.6	67 08.9	51.9	181 31.6	43.6	51 02.8	53.7	84 13.0	167	5 05.6	−127
14	279 08.7	47 40.3	41.5	82 09.9	52.5	196 34.4	43.6	66 05.0	53.8	98 48.7	167	5 18.3	−127
15	294 11.1	62 39.6	·· 42.3	97 11.0	·· 53.1	211 37.2	·· 43.5	81 07.2	·· 53.9	113 24.4	167	• 5 31.0	−127
16	309 13.6	77 38.9	43.2	112 12.0	53.7	226 40.0	43.5	96 09.4	54.0	128 00.1	166	5 43.7	−127
17	324 16.0	92 38.2	44.0	127 13.1	54.3	241 42.8	43.5	111 11.6	54.1	142 35.7	167	5 56.4	−127
18	339 18.5	107 37.5	−17 44.9	142 14.1	− 5 54.9	256 45.7	+22 43.5	126 13.8	−10 54.2	157 11.4	166	− 6 09.1	−126
19	354 21.0	122 36.8	45.7	157 15.2	55.5	271 48.5	43.5	141 16.0	54.3	171 47.0	166	6 21.7	−126
20	9 23.4	137 36.1	46.6	172 16.2	56.0	286 51.3	43.5	156 18.2	54.3	186 22.6	165	6 34.3	−126
21	24 25.9	152 35.4	·· 47.4	187 17.2	·· 56.6	301 54.1	·· 43.5	171 20.4	·· 54.4	200 58.1	165	• 6 46.9	−125
22	39 28.4	167 34.7	48.3	202 18.3	57.2	316 56.9	43.5	186 22.6	54.5	215 33.6	166	6 59.4	−126
23	54 30.8	182 33.9	49.1	217 19.3	57.8	331 59.7	43.4	201 24.8	54.6	230 09.2	164	7 12.0	−125
1 0	69 33.3	197 33.2	−17 50.0	232 20.4	− 5 58.4	347 02.5	+22 43.4	216 27.0	−10 54.7	244 44.6	165	− 7 24.5	−125
1	84 35.8	212 32.5	50.8	247 21.4	59.0	2 05.3	43.4	231 29.2	54.8	259 20.1	164	7 37.0	−124
2	99 38.2	227 31.8	51.7	262 22.4	5 59.5	17 08.1	43.4	246 31.4	54.8	273 55.5	164	7 49.4	−124
3	114 40.7	242 31.1	·· 52.5	277 23.5	• 6 00.1	32 11.0	·· 43.4	261 33.6	·· 54.9	288 30.9	163	• 8 01.8	−125
4	129 43.1	257 30.4	53.4	292 24.5	00.7	47 13.8	43.4	276 35.8	55.0	303 06.2	164	8 14.3	−123
5	144 45.6	272 29.7	54.2	307 25.6	01.3	62 16.6	43.4	291 38.0	55.1	317 41.6	162	8 26.6	−124
6	159 48.1	287 28.9	−17 55.0	322 26.6	− 6 01.9	77 19.4	+22 43.4	306 40.2	−10 55.2	332 16.8	163	− 8 39.0	−123
7	174 50.5	302 28.2	55.9	337 27.6	02.5	92 22.2	43.3	321 42.5	55.3	346 52.1	162	8 51.3	−123
8	189 53.0	317 27.5	56.7	352 28.7	03.1	107 25.0	43.3	336 44.7	55.4	1 27.3	162	9 03.6	−122
9	204 55.5	332 26.8	·· 57.6	7 29.7	·· 03.6	122 27.8	·· 43.3	351 46.9	·· 55.4	16 02.5	161	• 9 15.8	−123
10	219 57.9	347 26.1	58.4	22 30.8	04.2	137 30.6	43.3	6 49.1	55.5	30 37.6	161	9 28.1	−121
11	235 00.4	2 25.4	17 59.3	37 31.8	04.8	152 33.5	43.3	21 51.3	55.6	45 12.7	161	9 40.2	−122
12	250 02.9	17 24.6	−18 00.1	52 32.9	− 6 05.4	167 36.3	+22 43.3	36 53.5	−10 55.7	59 47.8	160	− 9 52.4	−121
13	265 05.3	32 23.9	00.9	67 33.9	06.0	182 39.1	43.3	51 55.7	55.8	74 22.8	160	10 04.5	−121
14	280 07.8	47 23.2	01.8	82 34.9	06.6	197 41.9	43.3	66 57.9	55.9	88 57.8	159	10 16.6	−121
15	295 10.3	62 22.5	·· 02.6	97 36.0	·· 07.2	212 44.7	·· 43.2	82 00.1	·· 56.0	103 32.7	159	•10 28.7	−120
16	310 12.7	77 21.8	03.4	112 37.0	07.7	227 47.5	43.2	97 02.3	56.0	118 07.6	159	10 40.7	−120
17	325 15.2	92 21.0	04.3	127 38.1	08.3	242 50.3	43.2	112 04.5	56.1	132 42.5	158	10 52.7	−119
18	340 17.6	107 20.3	−18 05.1	142 39.1	− 6 08.9	257 53.1	+22 43.2	127 06.7	−10 56.2	147 17.3	157	−11 04.6	−119
19	355 20.1	122 19.6	05.9	157 40.1	09.5	272 56.0	43.2	142 08.9	56.3	161 52.0	157	11 16.5	−119
20	10 22.6	137 18.9	06.8	172 41.2	10.1	287 58.8	43.2	157 11.1	56.4	176 26.7	157	11 28.4	−118
21	25 25.0	152 18.2	·· 07.6	187 42.2	·· 10.7	303 01.6	·· 43.2	172 13.3	·· 56.5	191 01.4	156	•11 40.2	−118
22	40 27.5	167 17.4	08.4	202 43.3	11.2	318 04.4	43.2	187 15.5	56.5	205 36.0	156	11 52.0	−117
23	55 30.0	182 16.7	09.3	217 44.3	11.8	333 07.2	43.1	202 17.7	56.6	220 10.6	155	12 03.7	−117
2 0	70 32.4	197 16.0	−18 10.1	232 45.3	− 6 12.4	348 10.0	+22 43.1	217 20.0	−10 56.7	234 45.1	154	−12 15.4	−117
1	85 34.9	212 15.3	10.9	247 46.4	13.0	3 12.8	43.1	232 22.2	56.8	249 19.5	154	12 27.1	−116
2	100 37.4	227 14.5	11.7	262 47.4	13.6	18 15.7	43.1	247 24.4	56.9	263 53.9	154	12 38.7	−116
3	115 39.8	242 13.8	·· 12.6	277 48.5	·· 14.2	33 18.5	·· 43.1	262 26.6	·· 57.0	278 28.3	153	•12 50.3	−115
4	130 42.3	257 13.1	13.4	292 49.5	14.7	48 21.3	43.1	277 28.8	57.0	293 02.6	152	13 01.8	−115
5	145 44.8	272 12.3	14.2	307 50.5	15.3	63 24.1	43.1	292 31.0	57.1	307 36.8	152	13 13.3	−114
6	160 47.2	287 11.6	−18 15.0	322 51.6	− 6 15.9	78 26.9	+22 43.1	307 33.2	−10 57.2	322 11.0	152	−13 24.7	−114
7	175 49.7	302 10.9	15.9	337 52.6	16.5	93 29.7	43.0	322 35.4	57.3	336 45.2	150	13 36.1	−113
8	190 52.1	317 10.2	16.7	352 53.7	17.1	108 32.6	43.0	337 37.6	57.4	351 19.2	150	13 47.4	−113
9	205 54.6	332 09.4	·· 17.5	7 54.7	·· 17.7	123 35.4	·· 43.0	352 39.8	·· 57.5	5 53.2	150	•13 58.7	−112
10	220 57.1	347 08.7	18.3	22 55.7	18.2	138 38.2	43.0	7 42.0	57.6	20 27.2	149	14 09.9	−112
11	235 59.5	2 08.0	19.1	37 56.8	18.8	153 41.0	43.0	22 44.2	57.6	35 01.1	148	14 21.1	−111
12	251 02.0	17 07.2	−18 20.0	52 57.8	− 6 19.4	168 43.8	+22 43.0	37 46.4	−10 57.7	49 34.9	148	−14 32.2	−111
13	266 04.5	32 06.5	20.8	67 58.9	20.0	183 46.6	43.0	52 48.6	57.8	64 08.7	147	14 43.3	−110
14	281 06.9	47 05.8	21.6	82 59.9	20.6	198 49.5	43.0	67 50.8	57.9	78 42.4	146	14 54.3	−110
15	296 09.4	62 05.0	·· 22.4	98 01.0	·· 21.1	213 52.3	·· 42.9	82 53.1	·· 58.0	93 16.0	146	•15 05.3	−109
16	311 11.9	77 04.3	23.2	113 02.0	21.7	228 55.1	42.9	97 55.3	58.1	107 49.6	145	15 16.2	−109
17	326 14.3	92 03.6	24.0	128 03.0	22.3	243 57.9	42.9	112 57.5	58.1	122 23.1	145	15 27.1	−108
18	341 16.8	107 02.8	−18 24.9	143 04.1	− 6 22.9	259 00.7	+22 42.9	127 59.7	−10 58.2	136 56.6	144	−15 37.9	−107
19	356 19.2	122 02.1	25.7	158 05.1	23.5	274 03.5	42.9	143 01.9	58.3	151 30.0	143	15 48.6	−107
20	11 21.7	137 01.4	26.5	173 06.2	24.1	289 06.4	42.9	158 04.1	58.4	166 03.3	142	15 59.3	−106
21	26 24.2	152 00.6	·· 27.3	188 07.2	·· 24.6	304 09.2	·· 42.9	173 06.3	·· 58.5	180 36.5	142	•16 09.9	−106
22	41 26.6	166 59.9	28.1	203 08.2	25.2	319 12.0	42.9	188 08.5	58.6	195 09.7	141	16 20.5	−105
23	56 29.1	181 59.2	28.9	218 09.3	25.8	334 14.8	42.8	203 10.7	58.6	209 42.8	141	16 31.0	−104
24	71 31.6	196 58.4	−18 29.7	233 10.3	− 6 26.4	349 17.6	+22 42.8	218 12.9	−10 58.7	224 15.9	139	−16 41.4	−104
code	−	− 7	− 8	+ 10	− 6	+ 28	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
30 0h	182 52.7	−21 34.0
1	197 52.4	34.4
2	212 52.2	34.8
3	227 52.0	35.2
4	242 51.8	35.6
5	257 51.6	36.0
6	272 51.3	−21 36.4
7	287 51.1	36.9
8	302 50.9	37.3
9	317 50.6	37.7
10	332 50.4	38.1
11	347 50.2	38.5
12	2 50.0	−21 38.9
13	17 49.7	39.3
14	32 49.5	39.7
15	47 49.3	40.1
16	62 49.1	40.5
17	77 48.8	40.9
18	92 48.6	−21 41.3
19	107 48.4	41.7
20	122 48.1	42.1
21	137 47.9	42.5
22	152 47.7	42.9
23	167 47.5	43.3
1 0h	182 47.2	−21 43.7
1	197 47.0	44.1
2	212 46.8	44.5
3	227 46.5	44.9
4	242 46.3	45.3
5	257 46.1	45.7
6	272 45.8	−21 46.1
7	287 45.6	46.5
8	302 45.4	46.9
9	317 45.1	47.3
10	332 44.9	47.7
11	347 44.7	48.1
12	2 44.4	−21 48.4
13	17 44.2	48.8
14	32 44.0	49.2
15	47 43.7	49.6
16	62 43.5	50.0
17	77 43.3	50.4
18	92 43.0	−21 50.8
19	107 42.8	51.2
20	122 42.5	51.5
21	137 42.3	51.9
22	152 42.1	52.3
23	167 41.8	52.7
2 0h	182 41.6	−21 53.1
1	197 41.4	53.4
2	212 41.1	53.8
3	227 40.9	54.2
4	242 40.6	54.6
5	257 40.4	55.0
6	272 40.2	−21 55.3
7	287 39.9	55.7
8	302 39.7	56.1
9	317 39.4	56.5
10	332 39.2	56.8
11	347 39.0	57.2
12	2 38.7	−21 57.6
13	17 38.5	57.9
14	32 38.2	58.3
15	47 38.0	58.7
16	62 37.8	59.1
17	77 37.5	59.4
18	92 37.3	−21 59.8
19	107 37.0	22 00.2
20	122 36.8	00.5
21	137 36.5	00.9
22	152 36.3	01.3
23	167 36.1	01.6
24	182 35.8	−22 02.0
code	—	− 4

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.3	−57 28.3
30	Acrux	173 59.9	−62 50.4
19	Adhara	255 47.3	−28 54.3
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	167 00.0	+56 12.3
34	Alkaid	153 34.3	+49 32.3
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.4	− 1 13.7
25	Alphard	218 39.9	− 8 27.4
41	Alphecca	126 49.1	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.7	+19 25.2
43	Atria	109 04.0	−68 56.8
22	Avior	234 36.1	−59 21.4
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.5	−52 40.0
12	Capella	281 40.0	+45 57.3
53	Deneb	50 02.2	+45 07.1
28	Denebola	183 19.2	+14 49.7
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.2	+61 59.7
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.2	−56 51.1
29	Gienah	176 38.5	−17 17.1
35	Hadar	149 52.0	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.7	+74 20.4
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.2	−69 31.3
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.3
21	Pollux	244 22.0	+28 08.3
20	Procyon	245 46.2	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.9	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.6	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.4	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.8	−16 38.9
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.2	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 30	1	2
h	m s	m s	m s
0	+11 31.1	+11 09.3	+10 46.9
6	+11 25.8	+11 03.8	+10 41.1
12	+11 20.3	+10 58.2	+10 35.4
18	+11 14.9	+10 52.5	+10 29.6
24	+11 09.3	+10 46.9	+10 23.7

Lat. N	Sunrise	Twlt. begins	Moonrise 30	1	2	3
°	h m	h m	h m	h m	h m	h m
72	▬	6 22	1 39	3 33	5 40	▬
70	▬	6 17	1 35	3 20	5 13	7 31
68	10 35	6 10	1 32	3 09	4 53	6 48
66	9 46	6 06	1 29	3 01	4 37	6 20
64	9 16	6 01	1 27	2 54	4 24	5 59
62	8 53	5 57	1 25	2 48	4 13	5 41
60	8 35	5 54	1 23	2 42	4 03	5 27
58	8 20	5 51	1 22	2 38	3 55	5 15
56	8 07	5 47	1 21	2 34	3 48	5 05
54	7 55	5 44	1 19	2 30	3 42	4 56
52	7 45	5 41	1 18	2 27	3 36	4 48
50	7 37	5 38	1 17	2 24	3 31	4 40
45	7 18	5 32	1 15	2 17	3 20	4 25
40	7 02	5 25	1 13	2 12	3 11	4 12
35	6 49	5 20	1 12	2 07	3 03	4 01
30	6 38	5 13	1 10	2 03	2 57	3 52
20	6 19	5 00	1 08	1 56	2 45	3 36
10	6 01	4 46	1 06	1 50	2 35	3 22
0	5 45	4 31	1 04	1 44	2 26	3 09
10	5 29	4 12	1 02	1 39	2 16	2 56
20	5 12	3 49	1 01	1 33	2 06	2 43
30	4 51	3 17	0 58	1 26	1 55	2 27
35	4 39	2 56	0 57	1 22	1 49	2 18
40	4 26	2 28	0 56	1 18	1 41	2 08
45	4 09	1 48	0 54	1 13	1 33	1 56
50	3 49	0 17	0 52	1 07	1 23	1 41
52	3 39	////	0 51	1 04	1 18	1 35
54	3 28	////	0 50	1 01	1 13	1 27
56	3 16	////	0 49	0 58	1 07	1 19
58	3 01	////	0 48	0 54	1 01	1 10
60	2 44	////	0 47	0 50	0 54	0 59
S						

Lat. N	Sunset	Twlt. ends	Moonset 30	1	2	3
°	h m	h m	h m	h m	h m	h m
72	▬	17 13	12 19	11 50	11 10	▬
70	▬	17 20	12 26	12 05	11 39	10 52
68	13 02	17 25	12 31	12 18	12 01	11 36
66	13 51	17 30	12 36	12 28	12 18	12 06
64	14 22	17 35	12 40	12 36	12 32	12 28
62	14 45	17 39	12 44	12 44	12 44	12 46
60	15 03	17 43	12 47	12 50	12 54	13 01
58	15 18	17 46	12 50	12 56	13 03	13 14
56	15 31	17 49	12 52	13 01	13 11	13 25
54	15 42	17 52	12 54	13 05	13 18	13 34
52	15 52	17 55	12 56	13 09	13 24	13 43
50	16 01	17 58	12 58	13 13	13 30	13 51
45	16 20	18 05	13 02	13 21	13 43	14 08
40	16 35	18 11	13 06	13 28	13 53	14 21
35	16 49	18 19	13 08	13 34	14 02	14 33
30	17 00	18 25	13 11	13 39	14 10	14 43
20	17 19	18 37	13 16	13 48	14 23	15 01
10	17 37	18 52	13 20	13 56	14 35	15 17
0	17 53	19 07	13 23	14 04	14 46	15 31
10	18 09	19 26	13 27	14 11	14 57	15 46
20	18 27	19 50	13 31	14 20	15 09	16 01
30	18 47	20 21	13 36	14 29	15 23	16 19
35	18 59	20 43	13 38	14 34	15 31	16 30
40	19 13	21 11	13 41	14 40	15 40	16 42
45	19 29	21 52	13 45	14 47	15 51	16 56
50	19 50	23 31	13 49	14 56	16 04	17 14
52	20 00	////	13 51	15 00	16 10	17 22
54	20 11	////	13 53	15 04	16 17	17 32
56	20 23	////	13 56	15 09	16 25	17 42
58	20 38	////	13 58	15 15	16 33	17 54
60	20 55	////	14 01	15 21	16 43	18 08
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
30	7 14	10 49	8 32	0 56	9 36
1	7 54	10 50	8 30	0 52	9 33
2	8 36	10 52	8 28	0 47	9 29
3	9 20	10 53	8 27	0 43	9 26

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	30	1	2
°	′	′	′
0	11.9	12.0	12.2
4	11.9	12.0	12.3
8	11.9	12.0	12.3
12	11.9	12.1	12.3
16	12.0	12.1	12.4
20	12.1	12.2	12.4
24	12.2	12.3	12.5
28	12.2	12.4	12.6
32	12.4	12.5	12.7
36	12.5	12.6	12.8
40	12.6	12.7	12.9
44	12.7	12.8	13.0
48	12.9	13.0	13.2
52	13.1	13.1	13.3
56	13.2	13.3	13.5
60	13.4	13.5	13.6
64	13.6	13.6	13.8
68	13.8	13.8	14.0
72	14.0	14.0	14.1
76	14.2	14.2	14.3
80	14.4	14.4	14.5
84	14.6	14.6	14.7
88	14.7	14.7	14.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	30	1	2
°	′	′	′
0	17.7	17.6	17.4
4	17.6	17.6	17.4
8	17.6	17.5	17.4
12	17.6	17.5	17.4
16	17.5	17.5	17.3
20	17.5	17.4	17.3
24	17.4	17.3	17.2
28	17.3	17.2	17.1
32	17.2	17.1	17.0
36	17.0	17.0	16.9
40	16.9	16.9	16.8
44	16.8	16.7	16.6
48	16.6	16.6	16.5
52	16.5	16.4	16.4
56	16.3	16.3	16.2
60	16.1	16.1	16.1
64	15.9	15.9	15.9
68	15.8	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.0
88	14.8	14.8	14.9
90			

Subtract from table, back cover

GMT	♈	VENUS −3.4		MARS 1.8		JUPITER −2.3		SATURN 0.9		MOON			
	GHA	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
3 0	71 31.6	196 58.4	−18 29.7	233 10.3	− 6 26.4	349 17.6	+22 42.8	218 12.9	−10 58.7	224 15.9	139	−16 41.4	−104
1	86 34.0	211 57.7	30.5	248 11.4	27.0	4 20.4	42.8	233 15.1	58.8	238 48.8	140	16 51.8	−103
2	101 36.5	226 57.0	31.3	263 12.4	27.5	19 23.3	42.8	248 17.3	58.9	253 21.8	138	17 02.1	−102
3	116 39.0	241 56.2	·· 32.1	278 13.4	·· 28.1	34 26.1	·· 42.8	263 19.6	·· 59.0	267 54.6	137	·17 12.3	−102
4	131 41.4	256 55.5	32.9	293 14.5	28.7	49 28.9	42.8	278 21.8	59.1	282 27.3	137	17 22.5	−101
5	146 43.9	271 54.7	33.7	308 15.5	29.3	64 31.7	42.8	293 24.0	59.1	297 00.0	136	17 32.6	−100
6	161 46.4	286 54.0	−18 34.5	323 16.6	− 6 29.9	79 34.5	+22 42.8	308 26.2	−10 59.2	311 32.6	136	−17 42.6	−100
7	176 48.8	301 53.3	35.3	338 17.6	30.5	94 37.4	42.7	323 28.4	59.3	326 05.2	135	17 52.6	− 99
8	191 51.3	316 52.5	36.1	353 18.6	31.0	109 40.2	42.7	338 30.6	59.4	340 37.7	133	18 02.5	− 98
9	206 53.7	331 51.8	·· 36.9	8 19.7	·· 31.6	124 43.0	·· 42.7	353 32.8	·· 59.5	355 10.0	134	·18 12.3	− 98
10	221 56.2	346 51.0	37.7	23 20.7	32.2	139 45.8	42.7	8 35.0	59.6	9 42.4	132	18 22.1	− 97
11	236 58.7	1 50.3	38.5	38 21.8	32.8	154 48.6	42.7	23 37.2	59.6	24 14.6	132	18 31.8	− 96
12	252 01.1	16 49.5	−18 39.3	53 22.8	− 6 33.4	169 51.5	+22 42.7	38 39.4	−10 59.7	38 46.8	131	−18 41.4	− 95
13	267 03.6	31 48.8	40.1	68 23.8	33.9	184 54.3	42.7	53 41.6	59.8	53 18.9	130	18 50.9	− 94
14	282 06.1	46 48.1	40.9	83 24.9	34.5	199 57.1	42.6	68 43.9	10 59.9	67 50.9	129	19 00.3	− 94
15	297 08.5	61 47.3	·· 41.7	98 25.9	·· 35.1	214 59.9	·· 42.6	83 46.1	·11 00.0	82 22.8	129	·19 09.7	− 93
16	312 11.0	76 46.6	42.5	113 27.0	35.7	230 02.7	42.6	98 48.3	00.1	96 54.7	128	19 19.0	− 92
17	327 13.5	91 45.8	43.3	128 28.0	36.3	245 05.5	42.6	113 50.5	00.1	111 26.5	127	19 28.2	− 92
18	342 15.9	106 45.1	−18 44.1	143 29.0	− 6 36.8	260 08.4	+22 42.6	128 52.7	−11 00.2	125 58.2	126	−19 37.4	− 90
19	357 18.4	121 44.3	44.9	158 30.1	37.4	275 11.2	42.6	143 54.9	00.3	140 29.8	125	19 46.4	− 90
20	12 20.9	136 43.6	45.7	173 31.1	38.0	290 14.0	42.6	158 57.1	00.4	155 01.3	125	19 55.4	− 89
21	27 23.3	151 42.8	·· 46.5	188 32.2	·· 38.6	305 16.8	·· 42.6	173 59.3	·· 00.5	169 32.8	124	·20 04.3	− 88
22	42 25.8	166 42.1	47.3	203 33.2	39.2	320 19.6	42.5	189 01.5	00.5	184 04.2	123	20 13.1	− 87
23	57 28.2	181 41.3	48.0	218 34.2	39.7	335 22.5	42.5	204 03.7	00.6	198 35.5	122	20 21.8	− 86
4 0	72 30.7	196 40.6	−18 48.8	233 35.3	− 6 40.3	350 25.3	+22 42.5	219 05.9	−11 00.7	213 06.7	122	−20 30.4	− 86
1	87 33.2	211 39.8	49.6	248 36.3	40.9	5 28.1	42.5	234 08.2	00.8	227 37.9	120	20 39.0	− 84
2	102 35.6	226 39.1	50.4	263 37.4	41.5	20 30.9	42.5	249 10.4	00.9	242 08.9	120	20 47.4	− 84
3	117 38.1	241 38.3	·· 51.2	278 38.4	·· 42.0	35 33.8	·· 42.5	264 12.6	·· 01.0	256 39.9	119	·20 55.8	− 83
4	132 40.6	256 37.6	52.0	293 39.4	42.6	50 36.6	42.5	279 14.8	01.0	271 10.8	118	21 04.1	− 82
5	147 43.0	271 36.8	52.7	308 40.5	43.2	65 39.4	42.4	294 17.0	01.1	285 41.6	118	21 12.3	− 81
6	162 45.5	286 36.1	−18 53.5	323 41.5	− 6 43.8	80 42.2	+22 42.4	309 19.2	−11 01.2	300 12.4	116	−21 20.4	− 80
7	177 48.0	301 35.3	54.3	338 42.6	44.4	95 45.0	42.4	324 21.4	01.3	314 43.0	116	21 28.4	− 79
8	192 50.4	316 34.6	55.1	353 43.6	44.9	110 47.9	42.4	339 23.6	01.4	329 13.6	115	21 36.3	− 78
9	207 52.9	331 33.8	·· 55.9	8 44.6	·· 45.5	125 50.7	·· 42.4	354 25.8	·· 01.5	343 44.1	115	·21 44.1	− 77
10	222 55.4	346 33.1	56.6	23 45.7	46.1	140 53.5	42.4	9 28.0	01.5	358 14.6	113	21 51.8	− 76
11	237 57.8	1 32.3	57.4	38 46.7	46.7	155 56.3	42.4	24 30.3	01.6	12 44.9	113	21 59.4	− 75
12	253 00.3	16 31.5	−18 58.2	53 47.8	− 6 47.3	170 59.1	+22 42.4	39 32.5	−11 01.7	27 15.2	111	−22 06.9	− 74
13	268 02.7	31 30.8	59.0	68 48.8	47.8	186 02.0	42.3	54 34.7	01.8	41 45.3	111	22 14.3	− 73
14	283 05.2	46 30.0	18 59.7	83 49.8	48.4	201 04.8	42.3	69 36.9	01.9	56 15.4	111	22 21.6	− 72
15	298 07.7	61 29.3	·19 00.5	98 50.9	·· 49.0	216 07.6	·· 42.3	84 39.1	·· 01.9	70 45.5	109	·22 28.8	− 71
16	313 10.1	76 28.5	01.3	113 51.9	49.6	231 10.4	42.3	99 41.3	02.0	85 15.4	109	22 35.9	− 70
17	328 12.6	91 27.8	02.1	128 53.0	50.1	246 13.3	42.3	114 43.5	02.1	99 45.3	107	22 42.9	− 69
18	343 15.1	106 27.0	−19 02.8	143 54.0	− 6 50.7	261 16.1	+22 42.3	129 45.7	−11 02.2	114 15.0	107	−22 49.8	− 68
19	358 17.5	121 26.2	03.6	158 55.0	51.3	276 18.9	42.3	144 47.9	02.3	128 44.7	107	22 56.6	− 67
20	13 20.0	136 25.5	04.4	173 56.1	51.9	291 21.7	42.2	159 50.2	02.4	143 14.4	105	23 03.3	− 65
21	28 22.5	151 24.7	·· 05.1	188 57.1	·· 52.5	306 24.5	·· 42.2	174 52.4	·· 02.4	157 43.9	105	·23 09.8	− 65
22	43 24.9	166 24.0	05.9	203 58.2	53.0	321 27.4	42.2	189 54.6	02.5	172 13.4	104	23 16.3	− 63
23	58 27.4	181 23.2	06.7	218 59.2	53.6	336 30.2	42.2	204 56.8	02.6	186 42.8	103	23 22.6	− 63
5 0	73 29.9	196 22.4	−19 07.4	234 00.2	− 6 54.2	351 33.0	+22 42.2	219 59.0	−11 02.7	201 12.1	102	−23 28.9	− 61
1	88 32.3	211 21.7	08.2	249 01.3	54.8	6 35.8	42.2	235 01.2	02.8	215 41.3	102	23 35.0	− 60
2	103 34.8	226 20.9	08.9	264 02.3	55.3	21 38.7	42.2	250 03.4	02.8	230 10.5	100	23 41.0	− 59
3	118 37.2	241 20.1	·· 09.7	279 03.4	·· 55.9	36 41.5	·· 42.2	265 05.6	·· 02.9	244 39.5	100	·23 46.9	− 58
4	133 39.7	256 19.4	10.5	294 04.4	56.5	51 44.3	42.1	280 07.9	03.0	259 08.5	100	23 52.7	− 57
5	148 42.2	271 18.6	11.2	309 05.4	57.1	66 47.1	42.1	295 10.1	03.1	273 37.5	98	23 58.4	− 55
6	163 44.6	286 17.9	−19 12.0	324 06.5	− 6 57.6	81 50.0	+22 42.1	310 12.3	−11 03.2	288 06.3	98	−24 03.9	− 54
7	178 47.1	301 17.1	12.7	339 07.5	58.2	96 52.8	42.1	325 14.5	03.3	302 35.1	97	24 09.3	− 53
8	193 49.6	316 16.3	13.5	354 08.5	58.8	111 55.6	42.1	340 16.7	03.3	317 03.8	97	24 14.6	− 52
9	208 52.0	331 15.6	·· 14.3	9 09.6	·· 59.4	126 58.4	·· 42.1	355 18.9	·· 03.4	331 32.5	95	·24 19.8	− 51
10	223 54.5	346 14.8	15.0	24 10.6	6 59.9	142 01.3	42.1	10 21.1	03.5	346 01.0	95	24 24.9	− 49
11	238 57.0	1 14.0	15.8	39 11.7	7 00.5	157 04.1	42.0	25 23.3	03.6	0 29.5	95	24 29.8	− 48
12	253 59.4	16 13.3	−19 16.5	54 12.7	− 7 01.1	172 06.9	+22 42.0	40 25.6	−11 03.7	14 58.0	93	−24 34.6	− 47
13	269 01.9	31 12.5	17.3	69 13.7	01.7	187 09.7	42.0	55 27.8	03.7	29 26.3	93	24 39.3	− 46
14	284 04.3	46 11.7	18.0	84 14.8	02.3	202 12.6	42.0	70 30.0	03.8	43 54.6	92	24 43.9	− 45
15	299 06.8	61 10.9	·· 18.8	99 15.8	·· 02.8	217 15.4	·· 42.0	85 32.2	·· 03.9	58 22.8	92	·24 48.4	− 43
16	314 09.3	76 10.2	19.5	114 16.9	03.4	232 18.2	42.0	100 34.4	04.0	72 51.0	91	24 52.7	− 42
17	329 11.7	91 09.4	20.3	129 17.9	04.0	247 21.0	42.0	115 36.6	04.1	87 19.1	90	24 56.9	− 40
18	344 14.2	106 08.6	−19 21.0	144 18.9	− 7 04.6	262 23.9	+22 41.9	130 38.8	−11 04.1	101 47.1	89	−25 00.9	− 39
19	359 16.7	121 07.9	21.8	159 20.0	05.1	277 26.7	41.9	145 41.0	04.2	116 15.0	89	25 04.8	− 38
20	14 19.1	136 07.1	22.5	174 21.0	05.7	292 29.5	41.9	160 43.3	04.3	130 42.9	89	25 08.6	− 37
21	29 21.6	151 06.3	·· 23.3	189 22.1	·· 06.3	307 32.3	·· 41.9	175 45.5	·· 04.4	145 10.8	87	·25 12.3	− 35
22	44 24.1	166 05.5	24.0	204 23.1	06.9	322 35.2	41.9	190 47.7	04.5	159 38.5	88	25 15.8	− 34
23	59 26.5	181 04.8	24.7	219 24.1	07.4	337 38.0	41.9	205 49.9	04.6	174 06.3	86	25 19.2	− 33
24	74 29.0	196 04.0	−19 25.5	234 25.2	− 7 08.0	352 40.8	+22 41.9	220 52.1	−11 04.6	188 33.9	86	−25 22.5	− 31
code	−	− 7	− 8	+ 10	− 5	+ 29	− 1	+ 22	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
3	0	182 35.8	−22 02.0
	1	197 35.6	02.3
	2	212 35.3	02.7
	3	227 35.1	03.1
	4	242 34.8	03.4
	5	257 34.6	03.8
	6	272 34.3	−22 04.1
	7	287 34.1	04.5
	8	302 33.8	04.9
	9	317 33.6	05.2
	10	332 33.4	05.6
	11	347 33.1	05.9
	12	2 32.9	−22 06.3
	13	17 32.6	06.6
	14	32 32.4	07.0
	15	47 32.1	07.3
	16	62 31.9	07.7
	17	77 31.6	08.0
	18	92 31.4	−22 08.4
	19	107 31.1	08.7
	20	122 30.9	09.1
	21	137 30.6	09.4
	22	152 30.4	09.8
	23	167 30.1	10.1
4	0	182 29.9	−22 10.5
	1	197 29.6	10.8
	2	212 29.4	11.2
	3	227 29.1	11.5
	4	242 28.9	11.9
	5	257 28.6	12.2
	6	272 28.4	−22 12.5
	7	287 28.1	12.9
	8	302 27.9	13.2
	9	317 27.6	13.6
	10	332 27.4	13.9
	11	347 27.1	14.2
	12	2 26.8	−22 14.6
	13	17 26.6	14.9
	14	32 26.3	15.2
	15	47 26.1	15.6
	16	62 25.8	15.9
	17	77 25.6	16.2
	18	92 25.3	−22 16.6
	19	107 25.1	16.9
	20	122 24.8	17.2
	21	137 24.6	17.6
	22	152 24.3	17.9
	23	167 24.0	18.2
5	0	182 23.8	−22 18.5
	1	197 23.5	18.9
	2	212 23.3	19.2
	3	227 23.0	19.5
	4	242 22.8	19.8
	5	257 22.5	20.2
	6	272 22.2	−22 20.5
	7	287 22.0	20.8
	8	302 21.7	21.1
	9	317 21.5	21.5
	10	332 21.2	21.8
	11	347 20.9	22.1
	12	2 20.7	−22 22.4
	13	17 20.4	22.7
	14	32 20.2	23.0
	15	47 19.9	23.4
	16	62 19.6	23.7
	17	77 19.4	24.0
	18	92 19.1	−22 24.3
	19	107 18.9	24.6
	20	122 18.6	24.9
	21	137 18.3	25.2
	22	152 18.1	25.6
	23	167 17.8	25.9
	24	182 17.6	−22 26.2
code		—	− 3

No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.9	−57 28.3
30	Acrux	173 59.8	−62 50.4
19	Adhara	255 47.3	−28 54.3
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.9	+56 12.3
34	Alkaid	153 34.2	+49 32.3
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.8	− 8 27.4
41	Alphecca	126 49.1	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.4
42	Antares	113 21.5	−26 19.9
37	Arcturus	146 36.7	+19 25.1
43	Atria	109 04.0	−68 56.8
22	Avior	234 36.0	−59 21.4
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.5	−52 40.0
12	Capella	281 40.0	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.2	+14 49.6
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.1	+61 59.7
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.7
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.2	−56 51.1
29	Gienah	176 38.4	−17 17.1
35	Hadar	149 52.0	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.7	+74 20.4
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.7	−36 08.6
24	Miapl'dus	221 49.1	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.3
21	Pollux	244 22.0	+28 08.3
20	Procyon	245 46.2	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.9	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.6	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.4	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.6	−10 55.3
23	Suhail	223 25.2	−43 14.5
49	Vega	81 09.6	+38 44.5
39	Zub'g'bl	137 55.2	−15 51.1

GMT h	Equation of Time (App.—Mean) 3 m s	4 m s	5 m s
0	+10 23.7	+10 00.0	+ 9 35.7
6	+10 17.9	+ 9 54.0	+ 9 29.5
12	+10 11.9	+ 9 47.9	+ 9 23.3
18	+10 06.0	+ 9 41.8	+ 9 17.0
24	+10 00.0	+ 9 35.7	+ 9 10.7

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 3 h m	4 h m	5 h m	6 h m
72	▬	6 29	▬	▬	▬	▬
70	▬	6 23	7 31	▬	▬	▬
68	10 54	6 16	6 48	9 50	▬	▬
66	9 57	6 10	6 20	8 18	▬	▬
64	9 24	6 06	5 59	7 41	9 31	11 36
62	9 00	6 02	5 41	7 14	8 48	10 12
60	8 41	5 58	5 27	6 54	8 19	9 36
58	8 25	5 54	5 15	6 37	7 57	9 09
56	8 11	5 51	5 05	6 23	7 40	8 49
54	8 00	5 47	4 56	6 11	7 24	8 32
52	7 50	5 44	4 48	6 00	7 11	8 17
50	7 40	5 42	4 40	5 51	7 00	8 04
45	7 21	5 35	4 25	5 31	6 36	7 38
40	7 05	5 27	4 12	5 14	6 17	7 18
35	6 52	5 21	4 01	5 01	6 01	7 00
30	6 40	5 15	3 52	4 49	5 47	6 46
20	6 20	5 02	3 36	4 29	5 24	6 20
10	6 03	4 47	3 22	4 12	5 04	5 59
0	5 47	4 32	3 09	3 56	4 46	5 38
10	5 30	4 13	2 56	3 40	4 27	5 18
20	5 12	3 49	2 43	3 22	4 07	4 57
30	4 51	3 16	2 27	3 03	3 44	4 32
35	4 39	2 55	2 18	2 52	3 31	4 17
40	4 25	2 26	2 08	2 39	3 16	4 00
45	4 08	1 45	1 56	2 23	2 58	3 40
50	3 47	////	1 41	2 05	2 35	3 15
52	3 37	////	1 35	1 56	2 24	3 03
54	3 26	////	1 27	1 46	2 12	2 49
56	3 13	////	1 19	1 35	1 58	2 33
58	2 58	////	1 10	1 22	1 42	2 13
60	2 40	////	0 59	1 08	1 22	1 49
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 3 h m	4 h m	5 h m	6 h m
72	▬	17 08	▬	▬	▬	▬
70	▬	17 16	10 52	▬	▬	▬
68	12 46	17 23	11 36	10 14	▬	▬
66	13 43	17 27	12 06	11 45	▬	▬
64	14 16	17 32	12 28	12 23	12 18	12 05
62	14 41	17 37	12 46	12 50	13 02	13 29
60	15 00	17 41	13 01	13 11	13 31	14 06
58	15 15	17 44	13 14	13 29	13 53	14 32
56	15 29	17 48	13 25	13 43	14 11	14 53
54	15 40	17 51	13 34	13 56	14 27	15 10
52	15 51	17 55	13 43	14 07	14 40	15 24
50	16 00	17 58	13 51	14 17	14 52	15 37
45	16 19	18 04	14 08	14 38	15 16	16 04
40	16 35	18 12	14 21	14 55	15 36	16 24
35	16 48	18 18	14 33	15 09	15 52	16 42
30	17 00	18 25	14 43	15 22	16 06	16 57
20	17 20	18 38	15 01	15 43	16 30	17 22
10	17 37	18 52	15 17	16 02	16 51	17 44
0	17 54	19 08	15 31	16 19	17 11	18 05
10	18 11	19 28	15 46	16 37	17 30	18 25
20	18 29	19 52	16 01	16 55	17 51	18 47
30	18 49	20 24	16 19	17 17	18 15	19 13
35	19 02	20 47	16 30	17 30	18 30	19 28
40	19 16	21 16	16 42	17 44	18 46	19 45
45	19 33	21 58	16 56	18 02	19 06	20 06
50	19 54	////	17 14	18 24	19 31	20 32
52	20 04	////	17 22	18 34	19 43	20 45
54	20 15	////	17 32	18 46	19 57	20 59
56	20 28	////	17 42	18 59	20 13	21 16
58	20 44	////	17 54	19 15	20 32	21 37
60	21 02	////	18 08	19 34	20 56	22 03
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
3	9 20	10 53	8 27	0 43	9 26
4	10 07	10 54	8 25	0 38	9 22
5	10 58	10 55	8 23	0 34	9 19
6	11 52	10 56	8 22	0 29	9 15

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	3 ′	4 ′	5 ′
0	12.6	13.1	13.6
4	12.6	13.1	13.7
8	12.7	13.2	13.7
12	12.7	13.2	13.7
16	12.7	13.2	13.7
20	12.8	13.3	13.8
24	12.9	13.3	13.8
28	12.9	13.4	13.8
32	13.0	13.5	13.9
36	13.1	13.5	14.0
40	13.2	13.6	14.0
44	13.3	13.7	14.1
48	13.4	13.8	14.2
52	13.6	13.9	14.3
56	13.7	14.0	14.3
60	13.8	14.1	14.4
64	14.0	14.3	14.5
68	14.1	14.4	14.6
72	14.3	14.5	14.7
76	14.4	14.6	14.8
80	14.6	14.8	14.9
84	14.8	14.9	15.0
88	14.9	15.0	15.1
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	3 ′	4 ′	5 ′
0	17.2	16.9	16.6
4	17.2	16.9	16.6
8	17.2	16.9	16.6
12	17.2	16.9	16.6
16	17.1	16.8	16.6
20	17.1	16.8	16.5
24	17.0	16.7	16.5
28	16.9	16.7	16.4
32	16.8	16.6	16.4
36	16.7	16.5	16.3
40	16.6	16.4	16.3
44	16.5	16.4	16.2
48	16.4	16.3	16.1
52	16.3	16.2	16.0
56	16.1	16.0	15.9
60	16.0	15.9	15.8
64	15.9	15.8	15.8
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.5
80	15.2	15.3	15.4
84	15.1	15.2	15.2
88	15.0	15.1	15.2
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
6 0	74 29.0	196 04.0	−19 25.5	234 25.2	− 7 08.0	352 40.8	+22 41.9	220 52.1	−11 04.6	188 33.9	86	−25 22.5	− 31
1	89 31.5	211 03.2	26.2	249 26.2	08.6	7 43.6	41.8	235 54.3	04.7	203 01.5	85	25 25.6	− 30
2	104 33.9	226 02.4	27.0	264 27.3	09.2	22 46.5	41.8	250 56.5	04.8	217 29.0	85	25 28.6	− 29
3	119 36.4	241 01.7	•• 27.7	279 28.3	•• 09.7	37 49.3	•• 41.8	265 58.8	•• 04.9	231 56.5	85	•25 31.5	− 27
4	134 38.8	256 00.9	28.5	294 29.3	10.3	52 52.1	41.8	281 01.0	05.0	246 24.0	83	25 34.2	− 26
5	149 41.3	271 00.1	29.2	309 30.4	10.9	67 54.9	41.8	296 03.2	05.0	260 51.3	84	25 36.8	− 25
6	164 43.8	285 59.3	−19 29.9	324 31.4	− 7 11.4	82 57.8	+22 41.8	311 05.4	−11 05.1	275 18.7	82	−25 39.3	− 23
7	179 46.2	300 58.6	30.7	339 32.4	12.0	98 00.6	41.8	326 07.6	05.2	289 45.9	83	25 41.6	− 21
8	194 48.7	315 57.8	31.4	354 33.5	12.6	113 03.4	41.8	341 09.8	05.3	304 13.2	81	25 43.7	− 21
9	209 51.2	330 57.0	•• 32.1	9 34.5	•• 13.2	128 06.2	•• 41.7	356 12.0	•• 05.4	318 40.3	82	•25 45.8	− 19
10	224 53.6	345 56.2	32.9	24 35.6	13.7	143 09.1	41.7	11 14.3	05.4	333 07.5	81	25 47.7	− 17
11	239 56.1	0 55.4	33.6	39 36.6	14.3	158 11.9	41.7	26 16.5	05.5	347 34.6	80	25 49.4	− 16
12	254 58.6	15 54.7	−19 34.3	54 37.6	− 7 14.9	173 14.7	+22 41.7	41 18.7	−11 05.6	2 01.6	80	−25 51.0	− 15
13	270 01.0	30 53.9	35.1	69 38.7	15.5	188 17.5	41.7	56 20.9	05.7	16 28.6	80	25 52.5	− 13
14	285 03.5	45 53.1	35.8	84 39.7	16.0	203 20.4	41.7	71 23.1	05.8	30 55.6	79	25 53.8	− 12
15	300 06.0	60 52.3	•• 36.5	99 40.8	•• 16.6	218 23.2	•• 41.7	86 25.3	•• 05.8	45 22.5	79	•25 55.0	− 10
16	315 08.4	75 51.5	37.2	114 41.8	17.2	233 26.0	41.6	101 27.5	05.9	59 49.4	78	25 56.0	− 9
17	330 10.9	90 50.8	38.0	129 42.8	17.8	248 28.8	41.6	116 29.8	06.0	74 16.2	79	25 56.9	− 8
18	345 13.3	105 50.0	−19 38.7	144 43.9	− 7 18.3	263 31.7	+22 41.6	131 32.0	−11 06.1	88 43.1	77	−25 57.7	− 6
19	0 15.8	120 49.2	39.4	159 44.9	18.9	278 34.5	41.6	146 34.2	06.2	103 09.8	78	25 58.3	− 4
20	15 18.3	135 48.4	40.1	174 46.0	19.5	293 37.3	41.6	161 36.4	06.2	117 36.6	77	25 58.7	− 3
21	30 20.7	150 47.6	•• 40.9	189 47.0	•• 20.0	308 40.2	•• 41.6	176 38.6	•• 06.3	132 03.3	77	•25 59.0	− 2
22	45 23.2	165 46.8	41.6	204 48.0	20.6	323 43.0	41.6	191 40.8	06.4	146 30.0	77	25 59.2	0
23	60 25.7	180 46.0	42.3	219 49.1	21.2	338 45.8	41.5	206 43.0	06.5	160 56.7	76	25 59.2	+ 2
7 0	75 28.1	195 45.3	−19 43.0	234 50.1	− 7 21.8	353 48.6	+22 41.5	221 45.3	−11 06.6	175 23.3	76	−25 59.0	+ 2
1	90 30.6	210 44.5	43.7	249 51.1	22.3	8 51.5	41.5	236 47.5	06.6	189 49.9	76	25 58.8	+ 5
2	105 33.1	225 43.7	44.5	264 52.2	22.9	23 54.3	41.5	251 49.7	06.7	204 16.5	76	25 58.3	+ 5
3	120 35.5	240 42.9	•• 45.2	279 53.2	•• 23.5	38 57.1	•• 41.5	266 51.9	•• 06.8	218 43.1	75	•25 57.8	+ 8
4	135 38.0	255 42.1	45.9	294 54.3	24.1	54 00.0	41.5	281 54.1	06.9	233 09.6	75	25 57.0	+ 8
5	150 40.5	270 41.3	46.6	309 55.3	24.6	69 02.8	41.5	296 56.3	07.0	247 36.1	76	25 56.2	+ 11
6	165 42.9	285 40.5	−19 47.3	324 56.3	− 7 25.2	84 05.6	+22 41.4	311 58.6	−11 07.0	262 02.7	75	−25 55.1	+ 11
7	180 45.4	300 39.7	48.0	339 57.4	25.8	99 08.4	41.4	327 00.8	07.1	276 29.2	74	25 54.0	+ 14
8	195 47.8	315 38.9	48.7	354 58.4	26.3	114 11.3	41.4	342 03.0	07.2	290 55.6	75	25 52.6	+ 14
9	210 50.3	330 38.2	•• 49.4	9 59.4	•• 26.9	129 14.1	•• 41.4	357 05.2	•• 07.3	305 22.1	75	•25 51.2	+ 17
10	225 52.8	345 37.4	50.2	25 00.5	27.5	144 16.9	41.4	12 07.4	07.4	319 48.6	74	25 49.5	+ 17
11	240 55.2	0 36.6	50.9	40 01.5	28.1	159 19.7	41.4	27 09.6	07.4	334 15.0	75	25 47.8	+ 19
12	255 57.7	15 35.8	−19 51.6	55 02.6	− 7 28.6	174 22.6	+22 41.4	42 11.9	−11 07.5	348 41.5	74	−25 45.9	+ 21
13	271 00.2	30 35.0	52.3	70 03.6	29.2	189 25.4	41.3	57 14.1	07.6	3 07.9	75	25 43.8	+ 22
14	286 02.6	45 34.2	53.0	85 04.6	29.8	204 28.2	41.3	72 16.3	07.7	17 34.4	74	25 41.6	+ 24
15	301 05.1	60 33.4	•• 53.7	100 05.7	•• 30.3	219 31.1	•• 41.3	87 18.5	•• 07.8	32 00.8	74	•25 39.2	+ 25
16	316 07.6	75 32.6	54.4	115 06.7	30.9	234 33.9	41.3	102 20.7	07.8	46 27.2	75	25 36.7	+ 27
17	331 10.0	90 31.8	55.1	130 07.8	31.5	249 36.7	41.3	117 22.9	07.9	60 53.7	74	25 34.0	+ 28
18	346 12.5	105 31.0	−19 55.8	145 08.8	− 7 32.0	264 39.5	+22 41.3	132 25.2	−11 08.0	75 20.1	75	−25 31.2	+ 30
19	1 14.9	120 30.2	56.5	160 09.8	32.6	279 42.4	41.3	147 27.4	08.1	89 46.6	74	25 28.2	+ 31
20	16 17.4	135 29.4	57.2	175 10.9	33.2	294 45.2	41.2	162 29.6	08.1	104 13.0	75	25 25.1	+ 32
21	31 19.9	150 28.6	•• 57.9	190 11.9	•• 33.8	309 48.0	•• 41.2	177 31.8	•• 08.2	118 39.5	74	•25 21.9	+ 35
22	46 22.3	165 27.8	58.6	205 12.9	34.3	324 50.9	41.2	192 34.0	08.3	133 05.9	75	25 18.4	+ 35
23	61 24.8	180 27.0	19 59.3	220 14.0	34.9	339 53.7	41.2	207 36.2	08.4	147 32.4	75	25 14.9	+ 37
8 0	76 27.3	195 26.2	−20 00.0	235 15.0	− 7 35.5	354 56.5	+22 41.2	222 38.5	−11 08.5	161 58.9	75	−25 11.2	+ 39
1	91 29.7	210 25.4	00.7	250 16.1	36.0	9 59.3	41.2	237 40.7	08.5	176 25.4	75	25 07.3	+ 40
2	106 32.2	225 24.6	01.4	265 17.1	36.6	25 02.2	41.2	252 42.9	08.6	190 51.9	75	25 03.3	+ 41
3	121 34.7	240 23.8	•• 02.1	280 18.1	•• 37.2	40 05.0	•• 41.1	267 45.1	•• 08.7	205 18.4	76	•24 59.2	+ 43
4	136 37.1	255 23.0	02.8	295 19.2	37.7	55 07.8	41.1	282 47.3	08.8	219 45.0	75	24 54.9	+ 45
5	151 39.6	270 22.2	03.5	310 20.2	38.3	70 10.7	41.1	297 49.5	08.9	234 11.5	76	24 50.4	+ 46
6	166 42.1	285 21.4	−20 04.1	325 21.2	− 7 38.9	85 13.5	+22 41.1	312 51.8	−11 08.9	248 38.1	76	−24 45.8	+ 47
7	181 44.5	300 20.6	04.8	340 22.3	39.5	100 16.3	41.1	327 54.0	09.0	263 04.7	76	24 41.1	+ 49
8	196 47.0	315 19.8	05.5	355 23.3	40.0	115 19.2	41.1	342 56.2	09.1	277 31.3	77	24 36.2	+ 50
9	211 49.4	330 19.0	•• 06.2	10 24.4	•• 40.6	130 22.0	•• 41.1	357 58.4	•• 09.2	291 58.0	77	•24 31.2	+ 52
10	226 51.9	345 18.2	06.9	25 25.4	41.2	145 24.8	41.0	13 00.6	09.3	306 24.7	77	24 26.0	+ 53
11	241 54.4	0 17.4	07.6	40 26.4	41.7	160 27.6	41.0	28 02.9	09.3	320 51.4	77	24 20.7	+ 54
12	256 56.8	15 16.6	−20 08.3	55 27.5	− 7 42.3	175 30.5	+22 41.0	43 05.1	−11 09.4	335 18.1	78	−24 15.3	+ 56
13	271 59.3	30 15.8	08.9	70 28.5	42.9	190 33.3	41.0	58 07.3	09.5	349 44.9	77	24 09.7	+ 58
14	287 01.8	45 15.0	09.6	85 29.6	43.4	205 36.1	41.0	73 09.5	09.6	4 11.6	79	24 03.9	+ 59
15	302 04.2	60 14.2	•• 10.3	100 30.6	•• 44.0	220 39.0	•• 41.0	88 11.7	•• 09.6	18 38.5	78	•23 58.0	+ 60
16	317 06.7	75 13.4	11.0	115 31.6	44.6	235 41.8	40.9	103 14.0	09.7	33 05.3	79	23 52.0	+ 62
17	332 09.2	90 12.6	11.7	130 32.7	45.1	250 44.6	40.9	118 16.2	09.8	47 32.2	79	23 45.8	+ 63
18	347 11.6	105 11.8	−20 12.4	145 33.7	− 7 45.7	265 47.5	+22 40.9	133 18.4	−11 09.9	61 59.1	80	−23 39.5	+ 64
19	2 14.1	120 11.0	13.0	160 34.7	46.3	280 50.3	40.9	148 20.6	10.0	76 26.1	80	23 33.1	+ 66
20	17 16.6	135 10.2	13.7	175 35.8	46.8	295 53.1	40.9	163 22.8	10.0	90 53.1	80	23 26.5	+ 67
21	32 19.0	150 09.4	•• 14.4	190 36.8	•• 47.4	310 55.9	•• 40.9	178 25.0	•• 10.1	105 20.1	80	•23 19.8	+ 69
22	47 21.5	165 08.5	15.1	205 37.9	48.0	325 58.8	40.9	193 27.3	10.2	119 47.1	82	23 12.9	+ 70
23	62 23.9	180 07.7	15.7	220 38.9	48.5	341 01.6	40.8	208 29.5	10.3	134 14.3	81	23 05.9	+ 71
24	77 26.4	195 06.9	−20 16.4	235 39.9	− 7 49.1	356 04.4	+22 40.8	223 31.7	−11 10.3	148 41.4	82	−22 58.8	+ 73
code	—	− 8	− 7	+ 10	− 6	+ 28	− 1	+ 22	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
6	0	182 17.6	−22 26.2
	1	197 17.3	26.5
	2	212 17.0	26.8
	3	227 16.8	27.1
	4	242 16.5	27.4
	5	257 16.2	27.7
	6	272 16.0	−22 28.0
	7	287 15.7	28.3
	8	302 15.4	28.6
	9	317 15.2	28.9
	10	332 14.9	29.2
	11	347 14.7	29.5
	12	2 14.4	−22 29.8
	13	17 14.1	30.1
	14	32 13.9	30.4
	15	47 13.6	30.7
	16	62 13.3	31.0
	17	77 13.1	31.3
	18	92 12.8	−22 31.6
	19	107 12.5	31.9
	20	122 12.3	32.2
	21	137 12.0	32.5
	22	152 11.7	32.8
	23	167 11.5	33.1
7	0	182 11.2	−22 33.4
	1	197 10.9	33.7
	2	212 10.6	34.0
	3	227 10.4	34.2
	4	242 10.1	34.5
	5	257 09.8	34.8
	6	272 09.6	−22 35.1
	7	287 09.3	35.4
	8	302 09.0	35.7
	9	317 08.8	36.0
	10	332 08.5	36.2
	11	347 08.2	36.5
	12	2 08.0	−22 36.8
	13	17 07.7	37.1
	14	32 07.4	37.4
	15	47 07.1	37.6
	16	62 06.9	37.9
	17	77 06.6	38.2
	18	92 06.3	−22 38.5
	19	107 06.1	38.8
	20	122 05.8	39.0
	21	137 05.5	39.3
	22	152 05.2	39.6
	23	167 05.0	39.9
8	0	182 04.7	−22 40.1
	1	197 04.4	40.4
	2	212 04.1	40.7
	3	227 03.9	40.9
	4	242 03.6	41.2
	5	257 03.3	41.5
	6	272 03.0	−22 41.7
	7	287 02.8	42.0
	8	302 02.5	42.3
	9	317 02.2	42.5
	10	332 01.9	42.8
	11	347 01.7	43.1
	12	2 01.4	−22 43.3
	13	17 01.1	43.6
	14	32 00.8	43.9
	15	47 00.6	44.1
	16	62 00.3	44.4
	17	77 00.0	44.6
	18	91 59.7	−22 44.9
	19	106 59.5	45.2
	20	121 59.2	45.4
	21	136 58.9	45.7
	22	151 58.6	45.9
	23	166 58.4	46.2
	24	181 58.1	−22 46.4
code		−	− 3

No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.3	−57 28.3
30	Acrux	173 59.8	−62 50.4
19	Adhara	255 47.3	−28 54.3
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.9	+56 12.2
34	Alkaid	153 34.2	+49 32.3
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.8	− 8 27.4
41	Alphecca	126 49.1	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.4
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.7	+19 25.1
43	Atria	109 04.0	−68 56.8
22	Avior	234 36.0	−59 21.4
13	Bellatrix	279 19.6	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.5	−52 40.0
12	Capella	281 40.0	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.2	+14 49.6
4	Diphda	349 40.4	−18 14.3
27	Dubhe	194 46.1	+61 59.6
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.6
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.1	−56 51.1
29	Gienah	176 38.4	−17 17.1
35	Hadar	149 52.0	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.7	+74 20.3
57	Markab	14 22.8	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.1	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.3
21	Pollux	244 21.9	+28 08.3
20	Procyon	245 46.1	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.9	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.5	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.4	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.5	−10 55.3
23	Suhail	223 25.2	−43 14.5
49	Vega	81 09.6	+38 44.4
39	Zub'g'bi	137 55.2	−15 51.1

GMT h	Equation of Time (App.—Mean) 6 m s	7 m s	8 m s
0	+ 9 10.7	+ 8 45.3	+ 8 19.3
6	+ 9 04.4	+ 8 38.8	+ 8 12.7
12	+ 8 58.1	+ 8 32.3	+ 8 06.1
18	+ 8 51.7	+ 8 25.8	+ 7 59.5
24	+ 8 45.3	+ 8 19.3	+ 7 52.9

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 6 h m	7 h m	8 h m	9 h m
72	▬	6 35	▬	▬	▬	▬
70	▬	6 28	▬	▬	▬	▬
68	11 18	6 21	▬	▬	▬	13 33
66	10 06	6 16	▬	▬	▬	12 40
64	9 31	6 11	11 36	12 22	12 12	12 07
62	9 06	6 07	10 12	11 07	11 33	11 43
60	8 46	6 02	9 36	10 31	11 05	11 23
58	8 30	5 58	9 09	10 06	10 43	11 07
56	8 16	5 54	8 49	9 45	10 26	10 53
54	8 04	5 52	8 32	9 28	10 11	10 42
52	7 53	5 48	8 17	9 14	9 58	10 31
50	7 44	5 45	8 04	9 01	9 46	10 22
45	7 24	5 37	7 38	8 34	9 22	10 02
40	7 08	5 30	7 18	8 14	9 03	9 45
35	6 55	5 24	7 00	7 56	8 47	9 32
30	6 43	5 17	6 46	7 41	8 33	9 20
20	6 22	5 04	6 20	7 16	8 09	8 59
10	6 04	4 49	5 59	6 54	7 49	8 41
0	5 48	4 32	5 38	6 34	7 29	8 24
10	5 31	4 13	5 18	6 13	7 10	8 07
20	5 13	3 49	4 57	5 51	6 49	7 49
30	4 52	3 16	4 32	5 26	6 25	7 28
35	4 39	2 54	4 17	5 11	6 11	7 16
40	4 25	2 25	4 00	4 54	5 55	7 02
45	4 08	1 41	3 40	4 33	5 35	6 45
50	3 46	////	3 15	4 07	5 11	6 24
52	3 36	////	3 03	3 54	4 59	6 14
54	3 24	////	2 49	3 40	4 45	6 03
56	3 11	////	2 33	3 23	4 30	5 50
58	2 55	////	2 13	3 02	4 11	5 35
60	2 37	////	1 49	2 36	3 48	5 17
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 6 h m	7 h m	8 h m	9 h m
72	▬	17 05	▬	▬	▬	▬
70	▬	17 13	▬	▬	▬	▬
68	12 25	17 20	▬	▬	▬	15 55
66	13 36	17 25	▬	▬	▬	16 48
64	14 12	17 31	12 05	13 15	15 21	17 19
62	14 37	17 35	13 29	14 29	16 00	17 43
60	14 57	17 40	14 06	15 05	16 27	18 02
58	15 13	17 43	14 32	15 31	16 49	18 17
56	15 27	17 47	14 53	15 51	17 06	18 30
54	15 39	17 51	15 10	16 08	17 21	18 42
52	15 49	17 54	15 24	16 23	17 33	18 52
50	15 59	17 57	15 37	16 35	17 44	19 01
45	16 19	18 05	16 04	17 01	18 08	19 20
40	16 35	18 12	16 24	17 22	18 26	19 35
35	16 48	18 18	16 42	17 39	18 42	19 48
30	17 00	18 25	16 57	17 54	18 55	19 59
20	17 21	18 39	17 22	18 19	19 18	20 18
10	17 38	18 53	17 44	18 40	19 37	20 34
0	17 55	19 10	18 05	19 00	19 56	20 50
10	18 12	19 29	18 25	19 20	20 14	21 05
20	18 30	19 53	18 47	19 42	20 33	21 21
30	18 52	20 27	19 13	20 06	20 56	21 39
35	19 04	20 49	19 28	20 21	21 08	21 50
40	19 19	21 20	19 45	20 38	21 23	22 02
45	19 36	22 04	20 06	20 58	21 41	22 17
50	19 57	////	20 32	21 23	22 03	22 34
52	20 08	////	20 45	21 35	22 13	22 42
54	20 19	////	20 59	21 49	22 25	22 51
56	20 33	////	21 16	22 04	22 38	23 02
58	20 48	////	21 37	22 23	22 54	23 13
60	21 07	////	22 03	22 47	23 12	23 27
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
6	11 52	10 56	8 22	0 29	9 15
7	12 47	10 58	8 20	0 25	9 12
8	13 43	10 59	8 18	0 20	9 08
9	14 37	11 00	8 17	0 16	9 05

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt. °	6 ′	7 ′	8 ′
0	14.3	15.0	15.7
4	14.3	15.0	15.7
8	14.3	15.0	15.7
12	14.3	15.1	15.7
16	14.3	15.1	15.7
20	14.4	15.1	15.7
24	14.4	15.1	15.7
28	14.4	15.1	15.7
32	14.4	15.1	15.7
36	14.5	15.1	15.7
40	14.5	15.1	15.7
44	14.6	15.2	15.6
48	14.6	15.2	15.6
52	14.7	15.2	15.6
56	14.7	15.2	15.6
60	14.8	15.3	15.6
64	14.9	15.3	15.6
68	14.9	15.3	15.6
72	15.0	15.3	15.6
76	15.1	15.4	15.6
80	15.1	15.4	15.6
84	15.2	15.4	15.6
88	15.3	15.4	15.6
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt. °	6 ′	7 ′	8 ′
0	16.3	15.8	15.5
4	16.3	15.8	15.5
8	16.3	15.8	15.5
12	16.2	15.8	15.5
16	16.2	15.8	15.5
20	16.2	15.8	15.5
24	16.2	15.8	15.5
28	16.1	15.8	15.5
32	16.1	15.8	15.5
36	16.1	15.8	15.5
40	16.0	15.7	15.5
44	16.0	15.7	15.5
48	15.9	15.7	15.5
52	15.9	15.7	15.5
56	15.8	15.7	15.5
60	15.7	15.6	15.5
64	15.7	15.6	15.5
68	15.6	15.6	15.5
72	15.6	15.6	15.6
76	15.5	15.5	15.6
80	15.4	15.5	15.6
84	15.3	15.5	15.6
88	15.3	15.4	15.6
90			

Subtract from table, back cover

New Moon 6

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.8 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
	h ° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
9 0	77 26.4	195 06.9	−20 16.4	235 39.9	− 7 49.1	356 04.4	+22 40.8	223 31.7	−11 10.3	148 41.4	82	−22 58.8	+ 73
1	92 28.9	210 06.1	17.1	250 41.0	49.7	11 07.3	40.8	238 33.9	10.4	163 08.6	82	22 51.5	+ 74
2	107 31.3	225 05.3	17.7	265 42.0	50.2	26 10.1	40.8	253 36.1	10.5	177 35.8	83	22 44.1	+ 75
3	122 33.8	240 04.5	•• 18.4	280 43.0	•• 50.8	41 12.9	•• 40.8	268 38.4	•• 10.6	192 03.1	83	•22 36.6	+ 77
4	137 36.3	255 03.7	19.1	295 44.1	51.4	56 15.8	40.8	283 40.6	10.7	206 30.4	84	22 28.9	+ 78
5	152 38.7	270 02.9	19.7	310 45.1	51.9	71 18.6	40.8	298 42.8	10.7	220 57.8	84	22 21.1	+ 79
6	167 41.2	285 02.1	−20 20.4	325 46.2	− 7 52.5	86 21.4	+22 40.7	313 45.0	−11 10.8	235 25.2	84	−22 13.2	+ 81
7	182 43.7	300 01.2	21.1	340 47.2	53.1	101 24.2	40.7	328 47.2	10.9	249 52.6	85	22 05.1	+ 81
8	197 46.1	315 00.4	21.7	355 48.2	53.6	116 27.1	40.7	343 49.5	11.0	264 20.1	85	21 57.0	+ 84
9	212 48.6	329 59.6	•• 22.4	10 49.3	•• 54.2	131 29.9	•• 40.7	358 51.7	•• 11.0	278 47.6	86	•21 48.6	+ 84
10	227 51.1	344 58.8	23.1	25 50.3	54.8	146 32.7	40.7	13 53.9	11.1	293 15.2	87	21 40.2	+ 86
11	242 53.5	359 58.0	23.7	40 51.3	55.3	161 35.6	40.7	28 56.1	11.2	307 42.9	87	21 31.6	+ 87
12	257 56.0	14 57.2	−20 24.4	55 52.4	− 7 55.9	176 38.4	+22 40.6	43 58.3	−11 11.3	322 10.6	87	−21 22.9	+ 88
13	272 58.4	29 56.4	25.0	70 53.4	56.5	191 41.2	40.6	59 00.6	11.4	336 38.3	88	21 14.1	+ 89
14	288 00.9	44 55.5	25.7	85 54.5	57.0	206 44.1	40.6	74 02.8	11.4	351 06.1	88	21 05.2	+ 91
15	303 03.4	59 54.7	•• 26.4	100 55.5	•• 57.6	221 46.9	•• 40.6	89 05.0	•• 11.5	5 33.9	89	•20 56.1	+ 92
16	318 05.8	74 53.9	27.0	115 56.5	58.2	236 49.7	40.6	104 07.2	11.6	20 01.8	89	20 46.9	+ 93
17	333 08.3	89 53.1	27.7	130 57.6	58.7	251 52.6	40.6	119 09.5	11.7	34 29.7	90	20 37.6	+ 94
18	348 10.8	104 52.3	−20 28.3	145 58.6	− 7 59.3	266 55.4	+22 40.6	134 11.7	−11 11.7	48 57.7	91	−20 28.2	+ 96
19	3 13.2	119 51.4	29.0	160 59.6	7 59.9	281 58.2	40.5	149 13.9	11.8	63 25.8	91	20 18.6	+ 96
20	18 15.7	134 50.6	29.6	176 00.7	8 00.4	297 01.1	40.5	164 16.1	11.9	77 53.9	91	20 09.0	+ 98
21	33 18.2	149 49.8	•• 30.3	191 01.7	•• 01.0	312 03.9	•• 40.5	179 18.3	•• 12.0	92 22.0	92	•19 59.2	+ 99
22	48 20.6	164 49.0	30.9	206 02.7	01.6	327 06.7	40.5	194 20.6	12.1	106 50.2	92	19 49.3	+100
23	63 23.1	179 48.2	31.6	221 03.8	02.1	342 09.5	40.5	209 22.8	12.1	121 18.4	93	19 39.3	+102
10 0	78 25.6	194 47.3	−20 32.2	236 04.8	− 8 02.7	357 12.4	+22 40.5	224 25.0	−11 12.2	135 46.7	94	−19 29.1	+102
1	93 28.0	209 46.5	32.9	251 05.9	03.3	12 15.2	40.5	239 27.2	12.3	150 15.1	94	19 18.9	+103
2	108 30.5	224 45.7	33.5	266 06.9	03.8	27 18.0	40.4	254 29.4	12.4	164 43.5	95	19 08.6	+105
3	123 32.9	239 44.9	•• 34.2	281 07.9	•• 04.4	42 20.9	•• 40.4	269 31.7	•• 12.4	179 12.0	95	•18 58.1	+106
4	138 35.4	254 44.1	34.8	296 09.0	05.0	57 23.7	40.4	284 33.9	12.5	193 40.5	95	18 47.5	+107
5	153 37.9	269 43.2	35.5	311 10.0	05.5	72 26.5	40.4	299 36.1	12.6	208 09.0	97	18 36.8	+107
6	168 40.3	284 42.4	−20 36.1	326 11.0	− 8 06.1	87 29.4	+22 40.4	314 38.3	−11 12.7	222 37.7	96	−18 26.1	+109
7	183 42.8	299 41.6	36.7	341 12.1	06.7	102 32.2	40.4	329 40.6	12.7	237 06.3	98	18 15.2	+110
8	198 45.3	314 40.8	37.4	356 13.1	07.2	117 35.0	40.3	344 42.8	12.8	251 35.1	97	18 04.2	+111
9	213 47.7	329 39.9	•• 38.0	11 14.2	•• 07.8	132 37.9	•• 40.3	359 45.0	•• 12.9	266 03.8	99	•17 53.1	+112
10	228 50.2	344 39.1	38.7	26 15.2	08.3	147 40.7	40.3	14 47.2	13.0	280 32.7	98	17 41.9	+113
11	243 52.7	359 38.3	39.3	41 16.2	08.9	162 43.5	40.3	29 49.4	13.1	295 01.5	100	17 30.6	+114
12	258 55.1	14 37.4	−20 39.9	56 17.3	− 8 09.5	177 46.4	+22 40.3	44 51.7	−11 13.1	309 30.5	100	−17 19.2	+115
13	273 57.6	29 36.6	40.6	71 18.3	10.0	192 49.2	40.3	59 53.9	13.2	323 59.5	100	17 07.7	+116
14	289 00.0	44 35.8	41.2	86 19.3	10.6	207 52.0	40.3	74 56.1	13.3	338 28.5	101	16 56.1	+117
15	304 02.5	59 35.0	•• 41.8	101 20.4	•• 11.2	222 54.9	•• 40.2	89 58.3	•• 13.4	352 57.6	101	•16 44.4	+118
16	319 05.0	74 34.1	42.5	116 21.4	11.7	237 57.7	40.2	105 00.6	13.4	7 26.7	102	16 32.6	+119
17	334 07.4	89 33.3	43.1	131 22.4	12.3	253 00.5	40.2	120 02.8	13.5	21 55.9	103	16 20.7	+120
18	349 09.9	104 32.5	−20 43.7	146 23.5	− 8 12.8	268 03.4	+22 40.2	135 05.0	−11 13.6	36 25.2	103	−16 08.7	+120
19	4 12.4	119 31.6	44.3	161 24.5	13.4	283 06.2	40.2	150 07.2	13.7	50 54.5	103	15 56.7	+122
20	19 14.8	134 30.8	45.0	176 25.6	14.0	298 09.0	40.2	165 09.5	13.7	65 23.8	104	15 44.5	+123
21	34 17.3	149 30.0	•• 45.6	191 26.6	•• 14.5	313 11.8	•• 40.1	180 11.7	•• 13.8	79 53.2	104	•15 32.2	+123
22	49 19.8	164 29.2	46.2	206 27.6	15.1	328 14.7	40.1	195 13.9	13.9	94 22.6	105	15 19.9	+124
23	64 22.2	179 28.3	46.9	221 28.7	15.7	343 17.5	40.1	210 16.1	14.0	108 52.1	105	15 07.5	+125
11 0	79 24.7	194 27.5	−20 47.5	236 29.7	− 8 16.2	358 20.3	+22 40.1	225 18.3	−11 14.0	123 21.6	106	−14 55.0	+126
1	94 27.2	209 26.7	48.1	251 30.7	16.8	13 23.2	40.1	240 20.6	14.1	137 51.2	107	14 42.4	+127
2	109 29.6	224 25.8	48.7	266 31.8	17.3	28 26.0	40.1	255 22.8	14.2	152 20.9	106	14 29.7	+128
3	124 32.1	239 25.0	•• 49.3	281 32.8	•• 17.9	43 28.8	•• 40.1	270 25.0	•• 14.3	166 50.5	108	•14 16.9	+128
4	139 34.5	254 24.1	50.0	296 33.9	18.5	58 31.7	40.0	285 27.2	14.4	181 20.3	107	14 04.1	+130
5	154 37.0	269 23.3	50.6	311 34.9	19.0	73 34.5	40.0	300 29.5	14.4	195 50.0	108	13 51.1	+130
6	169 39.5	284 22.5	−20 51.2	326 35.9	− 8 19.6	88 37.3	+22 40.0	315 31.7	−11 14.5	210 19.8	109	−13 38.1	+130
7	184 41.9	299 21.6	51.8	341 37.0	20.2	103 40.2	40.0	330 33.9	14.6	224 49.7	109	13 25.1	+132
8	199 44.4	314 20.8	52.4	356 38.0	20.7	118 43.0	40.0	345 36.1	14.7	239 19.6	109	13 11.9	+132
9	214 46.9	329 20.0	•• 53.0	11 39.0	•• 21.3	133 45.8	•• 40.0	0 38.4	•• 14.7	253 49.5	110	•12 58.7	+133
10	229 49.3	344 19.1	53.6	26 40.1	21.8	148 48.7	39.9	15 40.6	14.8	268 19.5	110	12 45.4	+134
11	244 51.8	359 18.3	54.3	41 41.1	22.4	163 51.5	39.9	30 42.8	14.9	282 49.5	111	12 32.0	+135
12	259 54.3	14 17.5	−20 54.9	56 42.1	− 8 23.0	178 54.3	+22 39.9	45 45.0	−11 15.0	297 19.6	111	−12 18.5	+135
13	274 56.7	29 16.6	55.5	71 43.2	23.5	193 57.2	39.9	60 47.3	15.0	311 49.7	112	12 05.0	+136
14	289 59.2	44 15.8	56.1	86 44.2	24.1	209 00.0	39.9	75 49.5	15.1	326 19.9	112	11 51.4	+136
15	305 01.7	59 14.9	•• 56.7	101 45.2	•• 24.6	224 02.8	•• 39.9	90 51.7	•• 15.2	340 50.1	112	•11 37.8	+138
16	320 04.1	74 14.1	57.3	116 46.3	25.2	239 05.7	39.9	105 53.9	15.3	355 20.3	112	11 24.0	+137
17	335 06.6	89 13.3	57.9	131 47.3	25.8	254 08.5	39.8	120 56.2	15.3	9 50.5	113	11 10.3	+139
18	350 09.0	104 12.4	−20 58.5	146 48.4	− 8 26.3	269 11.3	+22 39.8	135 58.4	−11 15.4	24 20.8	114	−10 56.4	+139
19	5 11.5	119 11.6	59.1	161 49.4	26.9	284 14.2	39.8	151 00.6	15.5	38 51.2	113	10 42.5	+140
20	20 14.0	134 10.7	20 59.7	176 50.4	27.4	299 17.0	39.8	166 02.8	15.6	53 21.5	114	10 28.5	+140
21	35 16.4	149 09.9	•21 00.3	191 51.5	•• 28.0	314 19.8	•• 39.8	181 05.1	•• 15.6	67 51.9	114	•10 14.5	+141
22	50 18.9	164 09.1	00.9	206 52.5	28.6	329 22.7	39.8	196 07.3	15.7	82 22.3	115	10 00.4	+142
23	65 21.4	179 08.2	01.5	221 53.5	29.1	344 25.5	39.7	211 09.5	15.8	96 52.8	115	9 46.2	+142
24	80 23.8	194 07.4	−21 02.1	236 54.6	− 8 29.7	359 28.3	+22 39.7	226 11.7	−11 15.9	111 23.3	115	− 9 32.0	+143
code	−	− 8	− 7	+ 10	− 5	+ 28	0	+ 22	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
9	0	181 58.1	−22 46.4
	1	196 57.8	46.7
	2	211 57.5	46.9
	3	226 57.2	47.2
	4	241 57.0	47.4
	5	256 56.7	47.7
	6	271 56.4	−22 47.9
	7	286 56.1	48.2
	8	301 55.8	48.4
	9	316 55.6	48.7
	10	331 55.3	48.9
	11	346 55.0	49.2
	12	1 54.7	−22 49.4
	13	16 54.4	49.7
	14	31 54.2	49.9
	15	46 53.9	50.1
	16	61 53.6	50.4
	17	76 53.3	50.6
	18	91 53.0	−22 50.9
	19	106 52.8	51.1
	20	121 52.5	51.3
	21	136 52.2	51.6
	22	151 51.9	51.8
	23	166 51.6	52.1
10	0	181 51.3	−22 52.3
	1	196 51.1	52.5
	2	211 50.8	52.8
	3	226 50.5	53.0
	4	241 50.2	53.2
	5	256 49.9	53.5
	6	271 49.7	−22 53.7
	7	286 49.4	53.9
	8	301 49.1	54.1
	9	316 48.8	54.4
	10	331 48.5	54.6
	11	346 48.2	54.8
	12	1 47.9	−22 55.1
	13	16 47.7	55.3
	14	31 47.4	55.5
	15	46 47.1	55.7
	16	61 46.8	56.0
	17	76 46.5	56.2
	18	91 46.2	−22 56.4
	19	106 46.0	56.6
	20	121 45.7	56.8
	21	136 45.4	57.1
	22	151 45.1	57.3
	23	166 44.8	57.5
11	0	181 44.5	−22 57.7
	1	196 44.2	57.9
	2	211 43.9	58.1
	3	226 43.7	58.3
	4	241 43.4	58.6
	5	256 43.1	58.8
	6	271 42.8	−22 59.0
	7	286 42.5	59.2
	8	301 42.2	59.4
	9	316 41.9	59.6
	10	331 41.6	22 59.8
	11	346 41.4	23 00.0
	12	1 41.1	−23 00.2
	13	16 40.8	00.4
	14	31 40.5	00.6
	15	46 40.2	00.9
	16	61 39.9	01.1
	17	76 39.6	01.3
	18	91 39.3	−23 01.5
	19	106 39.0	01.7
	20	121 38.8	01.9
	21	136 38.5	02.1
	22	151 38.2	02.3
	23	166 37.9	02.5
	24	181 37.6	−23 02.7
code		—	− 2

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.4	−57 28.3
30	Acrux	173 59.7	−62 50.5
19	Adhara	255 47.3	−28 54.4
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.9	+56 12.2
34	Alkaid	153 34.2	+49 32.3
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.8	− 8 27.4
41	Alphecca	126 49.1	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.4
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.6	+19 25.1
43	Atria	109 04.0	−68 56.8
22	Avior	234 36.0	−59 21.4
13	Bellatrix	279 19.5	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.4	−52 40.0
12	Capella	281 40.0	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.1	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 46.1	+61 59.6
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.6
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.1	−56 51.1
29	Gienah	176 38.4	−17 17.2
35	Hadar	149 51.9	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.6	+74 20.3
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.0	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.3
21	Pollux	244 21.9	+28 08.3
20	Procyon	245 46.1	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.8	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.5	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.4	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.5	−10 55.3
23	Suhail	223 25.1	−43 14.6
49	Vega	81 09.6	+38 44.4
39	Zub'g'bi	137 55.2	−15 51.1

GMT h	Equation of Time (App.—Mean) 9 m s	10 m s	11 m s
0	+ 7 52.9	+ 7 26.0	+ 6 58.7
6	+ 7 46.2	+ 7 19.2	+ 6 51.8
12	+ 7 39.5	+ 7 12.4	+ 6 44.8
18	+ 7 32.7	+ 7 05.5	+ 6 37.9
24	+ 7 26.0	+ 6 58.7	+ 6 31.0

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 9 h m	10 h m	11 h m	12 h m
72	▬	6 41	▬	14 09	13 00	12 23
70	▬	6 33	▬	13 18	12 39	12 14
68	▬	6 26	13 33	12 46	12 23	12 06
66	10 15	6 20	12 40	12 22	12 10	12 00
64	9 37	6 14	12 07	12 03	11 59	11 54
62	9 11	6 10	11 43	11 47	11 49	11 50
60	8 51	6 05	11 23	11 34	11 41	11 46
58	8 34	6 02	11 07	11 23	11 33	11 42
56	8 20	5 58	10 53	11 13	11 27	11 39
54	8 08	5 54	10 42	11 04	11 21	11 36
52	7 57	5 51	10 31	10 56	11 16	11 33
50	7 47	5 47	10 22	10 49	11 11	11 30
45	7 27	5 40	10 02	10 34	11 01	11 25
40	7 11	5 33	9 45	10 21	10 52	11 20
35	6 57	5 26	9 32	10 10	10 45	11 16
30	6 45	5 19	9 20	10 01	10 38	11 13
20	6 24	5 06	8 59	9 45	10 27	11 07
10	6 06	4 51	8 41	9 30	10 17	11 02
0	5 49	4 34	8 24	9 17	10 08	10 56
10	5 32	4 15	8 07	9 03	9 58	10 51
20	5 13	3 49	7 49	8 49	9 48	10 46
30	4 52	3 16	7 28	8 32	9 36	10 40
35	4 39	2 53	7 16	8 22	9 30	10 36
40	4 25	2 23	7 02	8 11	9 22	10 32
45	4 07	1 38	6 45	7 58	9 13	10 27
50	3 45	////	6 24	7 42	9 02	10 22
52	3 35	////	6 14	7 35	8 57	10 19
54	3 23	////	6 03	7 26	8 51	10 16
56	3 09	////	5 50	7 17	8 45	10 13
58	2 53	////	5 35	7 06	8 38	10 10
60	2 34	////	5 17	6 53	8 30	10 06

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 9 h m	10 h m	11 h m	12 h m
72	▬	17 02	▬	17 12	20 06	22 27
70	▬	17 11	▬	18 01	20 25	22 33
68	▬	17 18	15 55	18 32	20 39	22 38
66	13 30	17 24	16 48	18 55	20 51	22 42
64	14 08	17 29	17 19	19 12	21 00	22 45
62	14 34	17 34	17 43	19 27	21 08	22 48
60	14 55	17 39	18 02	19 39	21 15	22 51
58	15 12	17 43	18 17	19 49	21 21	22 53
56	15 26	17 47	18 30	19 58	21 27	22 55
54	15 38	17 50	18 42	20 06	21 32	22 57
52	15 49	17 54	18 52	20 13	21 36	22 58
50	15 58	17 57	19 01	20 20	21 40	23 00
45	16 18	18 04	19 20	20 34	21 48	23 03
40	16 35	18 12	19 35	20 45	21 55	23 06
35	16 49	18 19	19 48	20 55	22 01	23 08
30	17 01	18 26	19 59	21 03	22 07	23 10
20	17 21	18 39	20 18	21 17	22 16	23 14
10	17 40	18 55	20 34	21 30	22 24	23 17
0	17 57	19 12	20 50	21 41	22 31	23 19
10	18 14	19 31	21 05	21 53	22 38	23 22
20	18 32	19 56	21 21	22 05	22 46	23 25
30	18 54	20 30	21 39	22 19	22 55	23 28
35	19 06	20 52	21 50	22 27	23 00	23 30
40	19 21	21 23	22 02	22 36	23 05	23 32
45	19 39	22 09	22 17	22 46	23 12	23 35
50	20 01	////	22 34	22 59	23 19	23 37
52	20 11	////	22 42	23 04	23 23	23 39
54	20 23	////	22 51	23 11	23 27	23 40
56	20 37	////	23 02	23 18	23 31	23 42
58	20 53	////	23 13	23 26	23 36	23 43
60	21 13	////	23 27	23 35	23 41	23 45

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
9	14 37	11 00	8 17	0 16	9 05
10	15 29	11 01	8 15	0 11	9 01
11	16 19	11 03	8 13	0 07	8 58
12	17 08	11 04	8 12	{0 02 / 23 58}	8 54

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	9 ′	10 ′	11 ′
0	16.2	16.8	17.3
4	16.2	16.8	17.3
8	16.2	16.8	17.3
12	16.2	16.8	17.3
16	16.2	16.8	17.3
20	16.2	16.8	17.2
24	16.1	16.7	17.2
28	16.1	16.7	17.1
32	16.1	16.7	17.1
36	16.1	16.6	17.0
40	16.1	16.6	17.0
44	16.0	16.5	16.9
48	16.0	16.5	16.8
52	16.0	16.4	16.8
56	16.0	16.4	16.7
60	15.9	16.3	16.6
64	15.9	16.2	16.5
68	15.9	16.2	16.4
72	15.8	16.1	16.3
76	15.8	16.0	16.2
80	15.8	16.0	16.1
84	15.7	15.9	16.0
88	15.7	15.8	16.0
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	9 ′	10 ′	11 ′
0	15.2	14.8	14.5
4	15.2	14.8	14.5
8	15.2	14.8	14.6
12	15.2	14.9	14.6
16	15.2	14.9	14.6
20	15.2	14.9	14.6
24	15.2	14.9	14.7
28	15.3	15.0	14.7
32	15.3	15.0	14.8
36	15.3	15.0	14.8
40	15.3	15.1	14.9
44	15.3	15.1	15.0
48	15.4	15.2	15.0
52	15.4	15.2	15.1
56	15.4	15.3	15.2
60	15.5	15.4	15.3
64	15.5	15.4	15.4
68	15.5	15.5	15.5
72	15.5	15.5	15.5
76	15.6	15.6	15.6
80	15.6	15.7	15.7
84	15.7	15.8	15.8
88	15.7	15.8	15.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.9 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
12 0	80 23.8	194 07.4	−21 02.1	236 54.6	− 8 29.7	359 28.3	+22 39.7	226 11.7	−11 15.9	111 23.3	115	− 9 32.0	+143
1	95 26.3	209 06.5	02.7	251 55.6	30.2	14 31.2	39.7	241 14.0	15.9	125 53.8	116	9 17.7	+143
2	110 28.8	224 05.7	03.3	266 56.6	30.8	29 34.0	39.7	256 16.2	16.0	140 24.4	115	9 03.4	+144
3	125 31.2	239 04.8	·· 03.9	281 57.7	·· 31.4	44 36.8	·· 39.7	271 18.4	·· 16.1	154 54.9	116	· 8 49.0	+144
4	140 33.7	254 04.0	04.5	296 58.7	31.9	59 39.7	39.7	286 20.6	16.2	169 25.5	117	8 34.6	+145
5	155 36.2	269 03.1	05.1	311 59.8	32.5	74 42.5	39.6	301 22.9	16.2	183 56.2	116	8 20.1	+145
6	170 38.6	284 02.3	−21 05.7	327 00.8	− 8 33.0	89 45.3	+22 39.6	316 25.1	−11 16.3	198 26.8	117	− 8 05.6	+145
7	185 41.1	299 01.4	06.3	342 01.8	33.6	104 48.2	39.6	331 27.3	16.4	212 57.5	117	7 51.1	+147
8	200 43.5	314 00.6	06.9	357 02.9	34.2	119 51.0	39.6	346 29.6	16.5	227 28.2	117	7 36.4	+146
9	215 46.0	328 59.8	·· 07.5	12 03.9	·· 34.7	134 53.8	·· 39.6	1 31.8	·· 16.5	241 58.9	117	· 7 21.8	+147
10	230 48.5	343 58.9	08.0	27 04.9	35.3	149 56.7	39.6	16 34.0	16.6	256 29.6	118	7 07.1	+148
11	245 50.9	358 58.1	08.6	42 06.0	35.8	164 59.5	39.6	31 36.2	16.7	271 00.4	118	6 52.3	+148
12	260 53.4	13 57.2	−21 09.2	57 07.0	− 8 36.4	180 02.3	+22 39.5	46 38.5	−11 16.8	285 31.2	118	− 6 37.5	+148
13	275 55.9	28 56.4	09.8	72 08.0	36.9	195 05.2	39.5	61 40.7	16.8	300 02.0	118	6 22.7	+149
14	290 58.3	43 55.5	10.4	87 09.1	37.5	210 08.0	39.5	76 42.9	16.9	314 32.8	118	6 07.8	+149
15	306 00.8	58 54.7	·· 11.0	102 10.1	·· 38.1	225 10.8	·· 39.5	91 45.1	·· 17.0	329 03.6	119	· 5 52.9	+149
16	321 03.3	73 53.8	11.5	117 11.1	38.6	240 13.7	39.5	106 47.4	17.1	343 34.5	118	5 38.0	+150
17	336 05.7	88 53.0	12.1	132 12.2	39.2	255 16.5	39.5	121 49.6	17.1	358 05.3	119	5 23.0	+150
18	351 08.2	103 52.1	−21 12.7	147 13.2	− 8 39.7	270 19.3	+22 39.4	136 51.8	−11 17.2	12 36.2	119	− 5 08.0	+151
19	6 10.6	118 51.3	13.3	162 14.3	40.3	285 22.1	39.4	151 54.1	17.3	27 07.1	118	4 52.9	+151
20	21 13.1	133 50.4	13.9	177 15.3	40.9	300 25.0	39.4	166 56.3	17.4	41 37.9	119	4 37.8	+151
21	36 15.6	148 49.5	·· 14.4	192 16.3	·· 41.4	315 27.8	·· 39.4	181 58.5	·· 17.4	56 08.8	119	· 4 22.7	+151
22	51 18.0	163 48.7	15.0	207 17.4	42.0	330 30.6	39.4	197 00.7	17.5	70 39.7	120	4 07.6	+152
23	66 20.5	178 47.8	15.6	222 18.4	42.5	345 33.5	39.4	212 03.0	17.6	85 10.7	119	3 52.4	+152
13 0	81 23.0	193 47.0	−21 16.2	237 19.4	− 8 43.1	0 36.3	+22 39.3	227 05.2	−11 17.7	99 41.6	119	− 3 37.2	+152
1	96 25.4	208 46.1	16.7	252 20.5	43.6	15 39.1	39.3	242 07.4	17.7	114 12.5	119	3 22.0	+152
2	111 27.9	223 45.3	17.3	267 21.5	44.2	30 42.0	39.3	257 09.6	17.8	128 43.4	119	3 06.8	+153
3	126 30.4	238 44.4	·· 17.9	282 22.5	·· 44.8	45 44.8	·· 39.3	272 11.9	·· 17.9	143 14.3	120	· 2 51.5	+153
4	141 32.8	253 43.6	18.4	297 23.6	45.3	60 47.6	39.3	287 14.1	17.9	157 45.3	119	2 36.2	+153
5	156 35.3	268 42.7	19.0	312 24.6	45.9	75 50.5	39.3	302 16.3	18.0	172 16.2	119	2 20.9	+153
6	171 37.8	283 41.9	−21 19.6	327 25.6	− 8 46.4	90 53.3	+22 39.3	317 18.6	−11 18.1	186 47.1	119	− 2 05.6	+153
7	186 40.2	298 41.0	20.1	342 26.7	47.0	105 56.1	39.2	332 20.8	18.2	201 18.0	119	1 50.3	+154
8	201 42.7	313 40.1	20.7	357 27.7	47.5	120 59.0	39.2	347 23.0	18.2	215 48.9	119	1 34.9	+153
9	216 45.1	328 39.3	·· 21.3	12 28.7	·· 48.1	136 01.8	·· 39.2	2 25.2	·· 18.3	230 19.8	119	· 1 19.6	+154
10	231 47.6	343 38.4	21.8	27 29.8	48.6	151 04.6	39.2	17 27.5	18.4	244 50.7	119	1 04.2	+154
11	246 50.1	358 37.6	22.4	42 30.8	49.2	166 07.5	39.2	32 29.7	18.5	259 21.6	119	0 48.8	+154
12	261 52.5	13 36.7	−21 22.9	57 31.8	− 8 49.8	181 10.3	+22 39.2	47 31.9	−11 18.5	273 52.5	119	− 0 33.4	+154
13	276 55.0	28 35.8	23.5	72 32.9	50.3	196 13.1	39.1	62 34.2	18.6	288 23.4	119	0 18.0	+155
14	291 57.5	43 35.0	24.1	87 33.9	50.9	211 16.0	39.1	77 36.4	18.7	302 54.3	118	− 0 02.5	+154
15	306 59.9	58 34.1	·· 24.6	102 35.0	·· 51.4	226 18.8	·· 39.1	92 38.6	·· 18.8	317 25.1	118	+ 0 12.9	+154
16	322 02.4	73 33.3	25.2	117 36.0	52.0	241 21.6	39.1	107 40.9	18.8	331 55.9	119	0 28.3	+155
17	337 04.9	88 32.4	25.7	132 37.0	52.5	256 24.5	39.1	122 43.1	18.9	346 26.8	118	0 43.8	+154
18	352 07.3	103 31.5	−21 26.3	147 38.1	− 8 53.1	271 27.3	+22 39.1	137 45.3	−11 19.0	0 57.6	118	+ 0 59.2	+154
19	7 09.8	118 30.7	26.8	162 39.1	53.6	286 30.1	39.0	152 47.5	19.1	15 28.4	117	1 14.6	+155
20	22 12.3	133 29.8	27.4	177 40.1	54.2	301 33.0	39.0	167 49.8	19.1	29 59.1	118	1 30.1	+154
21	37 14.7	148 28.9	·· 27.9	192 41.2	·· 54.7	316 35.8	·· 39.0	182 52.0	·· 19.2	44 29.9	117	· 1 45.5	+154
22	52 17.2	163 28.1	28.5	207 42.2	55.3	331 38.6	39.0	197 54.2	19.3	59 00.6	117	2 00.9	+155
23	67 19.6	178 27.2	29.0	222 43.2	55.9	346 41.5	39.0	212 56.5	19.3	73 31.3	117	2 16.4	+154
14 0	82 22.1	193 26.4	−21 29.6	237 44.3	− 8 56.4	1 44.3	+22 39.0	227 58.7	−11 19.4	88 02.0	116	+ 2 31.8	+154
1	97 24.6	208 25.5	30.1	252 45.3	57.0	16 47.1	38.9	243 00.9	19.5	102 32.6	117	2 47.2	+154
2	112 27.0	223 24.6	30.7	267 46.3	57.5	31 50.0	38.9	258 03.2	19.6	117 03.3	116	3 02.6	+154
3	127 29.5	238 23.8	·· 31.2	282 47.4	·· 58.1	46 52.8	·· 38.9	273 05.4	·· 19.6	131 33.9	115	· 3 18.0	+154
4	142 32.0	253 22.9	31.7	297 48.4	58.6	61 55.6	38.9	288 07.6	19.7	146 04.4	116	3 33.4	+154
5	157 34.4	268 22.0	32.3	312 49.4	59.2	76 58.5	38.9	303 09.8	19.8	160 35.0	115	3 48.8	+154
6	172 36.9	283 21.2	−21 32.8	327 50.5	− 8 59.7	92 01.3	+22 38.9	318 12.1	−11 19.9	175 05.5	115	+ 4 04.2	+153
7	187 39.4	298 20.3	33.4	342 51.5	9 00.3	107 04.1	38.8	333 14.3	19.9	189 36.0	114	4 19.5	+153
8	202 41.8	313 19.4	33.9	357 52.5	00.8	122 07.0	38.8	348 16.5	20.0	204 06.4	114	4 34.8	+153
9	217 44.3	328 18.6	·· 34.4	12 53.6	·· 01.4	137 09.8	·· 38.8	3 18.8	·· 20.1	218 36.8	114	· 4 50.1	+153
10	232 46.7	343 17.7	35.0	27 54.6	01.9	152 12.6	38.8	18 21.0	20.1	233 07.2	114	5 05.4	+153
11	247 49.2	358 16.8	35.5	42 55.6	02.5	167 15.5	38.8	33 23.2	20.2	247 37.6	113	5 20.7	+153
12	262 51.7	13 15.9	−21 36.0	57 56.7	− 9 03.1	182 18.3	+22 38.8	48 25.5	−11 20.3	262 07.9	112	+ 5 36.0	+152
13	277 54.1	28 15.1	36.6	72 57.7	03.6	197 21.1	38.8	63 27.7	20.4	276 38.1	113	5 51.2	+152
14	292 56.6	43 14.2	37.1	87 58.8	04.2	212 24.0	38.7	78 29.9	20.4	291 08.4	111	6 06.4	+151
15	307 59.1	58 13.3	·· 37.6	102 59.8	·· 04.7	227 26.8	·· 38.7	93 32.2	·· 20.5	305 38.5	112	· 6 21.5	+152
16	323 01.5	73 12.5	38.2	118 00.8	05.3	242 29.6	38.7	108 34.4	20.6	320 08.7	111	6 36.7	+151
17	338 04.0	88 11.6	38.7	133 01.9	05.8	257 32.5	38.7	123 36.6	20.7	334 38.8	110	6 51.8	+151
18	353 06.5	103 10.7	−21 39.2	148 02.9	− 9 06.4	272 35.3	+22 38.7	138 38.9	−11 20.7	349 08.8	110	+ 7 06.9	+150
19	8 08.9	118 09.8	39.7	163 03.9	06.9	287 38.1	38.7	153 41.1	20.8	3 38.8	110	7 21.9	+151
20	23 11.4	133 09.0	40.3	178 05.0	07.5	302 41.0	38.6	168 43.3	20.9	18 08.8	109	7 37.0	+149
21	38 13.9	148 08.1	·· 40.8	193 06.0	·· 08.0	317 43.8	·· 38.6	183 45.6	·· 20.9	32 38.7	108	· 7 51.9	+150
22	53 16.3	163 07.2	41.3	208 07.0	08.6	332 46.6	38.6	198 47.8	21.0	47 08.5	108	8 06.9	+149
23	68 18.8	178 06.4	41.8	223 08.1	09.1	347 49.5	38.6	213 50.0	21.1	61 38.3	108	8 21.8	+148
24	83 21.2	193 05.5	−21 42.4	238 09.1	− 9 09.7	2 52.3	+22 38.6	228 52.3	−11 21.2	76 08.1	107	+ 8 36.6	+149
code	—	− 9	− 6	+ 11	− 5	+ 28	− 1	+ 23	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
12 0	181 37.6	−23 02.7
1	196 37.3	02.9
2	211 37.0	03.1
3	226 36.7 ••	03.2
4	241 36.4	03.4
5	256 36.1	03.6
6	271 35.9	−23 03.8
7	286 35.6	04.0
8	301 35.3	04.2
9	316 35.0 ••	04.4
10	331 34.7	04.6
11	346 34.4	04.8
12	1 34.1	−23 05.0
13	16 33.8	05.1
14	31 33.5	05.3
15	46 33.2 ••	05.5
16	61 32.9	05.7
17	76 32.6	05.9
18	91 32.3	−23 06.1
19	106 32.1	06.3
20	121 31.8	06.4
21	136 31.5 ••	06.6
22	151 31.2	06.8
23	166 30.9	07.0
13 0	181 30.6	−23 07.2
1	196 30.3	07.3
2	211 30.0	07.5
3	226 29.7 ••	07.7
4	241 29.4	07.9
5	256 29.1	08.0
6	271 28.8	−23 08.2
7	286 28.5	08.4
8	301 28.2	08.6
9	316 27.9 ••	08.7
10	331 27.6	08.9
11	346 27.3	09.1
12	1 27.1	−23 09.2
13	16 26.8	09.4
14	31 26.5	09.6
15	46 26.2 ••	09.7
16	61 25.9	09.9
17	76 25.6	10.1
18	91 25.3	−23 10.2
19	106 25.0	10.4
20	121 24.7	10.6
21	136 24.4 ••	10.7
22	151 24.1	10.9
23	166 23.8	11.0
14 0	181 23.5	−23 11.2
1	196 23.2	11.4
2	211 22.9	11.5
3	226 22.6 ••	11.7
4	241 22.3	11.8
5	256 22.0	12.0
6	271 21.7	−23 12.1
7	286 21.4	12.3
8	301 21.1	12.4
9	316 20.8 ••	12.6
10	331 20.5	12.7
11	346 20.2	12.9
12	1 19.9	−23 13.0
13	16 19.6	13.2
14	31 19.3	13.3
15	46 19.0 ••	13.5
16	61 18.7	13.6
17	76 18.4	13.8
18	91 18.1	−23 13.9
19	106 17.8	14.1
20	121 17.5	14.2
21	136 17.2 ••	14.3
22	151 16.9	14.5
23	166 16.6	14.6
24	181 16.3	−23 14.8
code	—	− 2

No.	Name	SHA	Dec.
	STARS	° ′	° ′
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.4	−57 28.3
30	Acrux	173 59.7	−62 50.5
19	Adhara	255 47.2	−28 54.4
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.8	+56 12.2
34	Alkaid	153 34.2	+49 32.2
55	Al Na'ir	28 39.7	−47 11.3
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.8	− 8 27.5
41	Alphecca	126 49.1	+26 52.0
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.5
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.6	+19 25.1
43	Atria	109 04.0	−68 56.8
22	Avior	234 35.9	−59 21.4
13	Bellatrix	279 19.5	+ 6 18.7
16	Betelg'se	271 49.3	+ 7 24.1
17	Canopus	264 15.4	−52 40.1
12	Capella	281 39.9	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.1	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 46.0	+61 59.6
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.6
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.0	−56 51.1
29	Gienah	176 38.4	−17 17.2
35	Hadar	149 51.9	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.6	+74 20.3
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 49.0	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.3
21	Pollux	244 21.9	+28 08.3
20	Procyon	245 46.1	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.8	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.4	−60 38.8
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.5	+56 17.5
45	Shaula	97 23.0	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.5	−10 55.3
23	Suhail	223 25.1	−43 14.6
49	Vega	81 09.6	+38 44.4
39	Zub'g'bi	137 55.2	−15 51.1

GMT	Equation of Time (App.—Mean) 12	13	14
h	m s	m s	m s
0	+ 6 31.0	+ 6 02.9	+ 5 34.6
6	+ 6 24.0	+ 5 55.9	+ 5 27.5
12	+ 6 17.0	+ 5 48.8	+ 5 20.3
18	+ 6 10.0	+ 5 41.7	+ 5 13.1
24	+ 6 02.9	+ 5 34.6	+ 5 05.9

Lat.	Sunrise	Twlt. begins	Moonrise 12	13	14	15
N °	h m	h m	h m	h m	h m	h m
72	■	6 45	12 23	11 54	11 24	10 49
70	■	6 38	12 14	11 53	11 31	11 07
68	■	6 31	12 06	11 52	11 37	11 21
66	10 23	6 23	12 00	11 51	11 42	11 33
64	9 43	6 18	11 54	11 51	11 47	11 43
62	9 16	6 13	11 50	11 50	11 50	11 51
60	8 55	6 09	11 46	11 50	11 54	11 59
58	8 38	6 04	11 42	11 49	11 57	12 05
56	8 23	6 01	11 39	11 49	11 59	12 11
54	8 11	5 57	11 36	11 49	12 02	12 16
52	8 00	5 54	11 33	11 48	12 04	12 21
50	7 50	5 50	11 30	11 48	12 06	12 25
45	7 30	5 42	11 25	11 48	12 10	12 34
40	7 13	5 35	11 20	11 47	12 14	12 42
35	6 59	5 28	11 16	11 47	12 17	12 49
30	6 47	5 21	11 13	11 46	12 20	12 55
20	6 26	5 07	11 07	11 46	12 25	13 05
10	6 08	4 52	11 02	11 45	12 29	13 15
0	5 51	4 35	10 56	11 45	12 33	13 24
10	5 33	4 16	10 51	11 44	12 37	13 32
20	5 14	3 50	10 46	11 44	12 42	13 42
30	4 53	3 16	10 40	11 43	12 47	13 53
35	4 40	2 54	10 36	11 43	12 50	13 59
40	4 25	2 23	10 32	11 43	12 54	14 06
45	4 07	1 36	10 27	11 42	12 58	14 15
50	3 45	////	10 22	11 42	13 03	14 25
52	3 34	////	10 19	11 42	13 05	14 30
54	3 22	////	10 16	11 42	13 07	14 35
56	3 08	////	10 13	11 41	13 10	14 41
58	2 52	////	10 10	11 41	13 13	14 48
60 S	2 32	////	10 06	11 41	13 17	14 55

Lat.	Sunset	Twlt. ends	Moonset 12	13	14	15
N °	h m	h m	h m	h m	h m	h m
72	■	17 01	22 27	24 41	0 41	3 01
70	■	17 10	22 33	24 37	0 37	2 46
68	■	17 17	22 38	24 34	0 34	2 34
66	13 25	17 23	22 42	24 31	0 31	2 24
64	14 05	17 29	22 45	24 29	0 29	2 16
62	14 32	17 33	22 48	24 27	0 27	2 09
60	14 53	17 38	22 51	24 26	0 26	2 03
58	15 11	17 43	22 53	24 24	0 24	1 58
56	15 25	17 47	22 55	24 23	0 23	1 53
54	15 37	17 50	22 57	24 22	0 22	1 49
52	15 48	17 54	22 58	24 21	0 21	1 45
50	15 58	17 57	23 00	24 20	0 20	1 42
45	16 19	18 06	23 03	24 18	0 18	1 34
40	16 35	18 12	23 06	24 16	0 16	1 28
35	16 49	18 20	23 08	24 15	0 15	1 23
30	17 01	18 26	23 10	24 14	0 14	1 18
20	17 22	18 41	23 14	24 11	0 11	1 10
10	17 41	18 56	23 17	24 09	0 09	1 03
0	17 58	19 13	23 19	24 07	0 07	0 57
10	18 15	19 32	23 22	24 06	0 06	0 50
20	18 34	19 58	23 25	24 04	0 04	0 43
30	18 56	20 32	23 28	24 01	0 01	0 36
35	19 09	20 56	23 30	24 00	0 00	0 31
40	19 24	21 27	23 32	23 59	24 26	0 26
45	19 41	22 12	23 35	23 57	24 20	0 20
50	20 04	////	23 37	23 55	24 13	0 13
52	20 14	////	23 39	23 54	24 10	0 10
54	20 27	////	23 40	23 53	24 06	0 06
56	20 41	////	23 42	23 52	24 02	0 02
58	20 57	////	23 43	23 50	23 58	24 08
60 S	21 17	////	23 45	23 49	23 53	23 59

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
12	17 08	11 04	8 12	0 02 / 23 58	8 54
13	17 56	11 06	8 10	23 53	8 50
14	18 45	11 07	8 09	23 49	8 47
15	19 36	11 08	8 07	23 44	8 43

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	12	13	14
°	′	′	′
0	17.7	18.2	18.5
4	17.7	18.2	18.5
8	17.7	18.2	18.4
12	17.7	18.2	18.4
16	17.6	18.1	18.4
20	17.6	18.1	18.3
24	17.5	18.0	18.2
28	17.5	17.9	18.2
32	17.4	17.9	18.1
36	17.4	17.8	18.0
40	17.3	17.7	17.9
44	17.2	17.6	17.8
48	17.1	17.5	17.7
52	17.0	17.4	17.5
56	16.9	17.2	17.4
60	16.8	17.1	17.3
64	16.7	17.0	17.1
68	16.6	16.8	17.0
72	16.5	16.7	16.8
76	16.4	16.6	16.7
80	16.3	16.4	16.5
84	16.1	16.3	16.3
88	16.0	16.2	16.2
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	12	13	14
°	′	′	′
0	14.3	14.0	13.9
4	14.3	14.0	13.9
8	14.3	14.1	13.9
12	14.4	14.1	13.9
16	14.4	14.1	14.0
20	14.4	14.2	14.0
24	14.5	14.2	14.1
28	14.5	14.3	14.2
32	14.6	14.4	14.3
36	14.7	14.5	14.4
40	14.8	14.6	14.5
44	14.8	14.7	14.6
48	14.9	14.8	14.7
52	15.0	14.9	14.8
56	15.1	15.0	15.0
60	15.2	15.1	15.1
64	15.3	15.3	15.2
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.8	15.8	15.9
84	15.9	16.0	16.0
88	16.0	16.1	16.1
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	VENUS −3.4 Dec.	MARS 1.7 GHA	MARS 1.7 Dec.	JUPITER −2.3 GHA	JUPITER −2.3 Dec.	SATURN 0.9 GHA	SATURN 0.9 Dec.	MOON GHA	MOON code	MOON Dec.	MOON code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
15 0	83 21.2	193 05.5	−21 42.4	238 09.1	− 9 09.7	2 52.3	+22 38.6	228 52.3	−11 21.2	76 08.1	107	+ 8 36.6	+149
1	98 23.7	208 04.6	42.9	253 10.1	10.2	17 55.1	38.6	243 54.5	21.2	90 37.8	107	8 51.5	+147
2	113 26.2	223 03.7	43.4	268 11.2	10.8	32 58.0	38.5	258 56.7	21.3	105 07.5	105	9 06.2	+148
3	128 28.6	238 02.9	·· 43.9	283 12.2	·· 11.3	48 00.8	·· 38.5	273 58.9	·· 21.4	119 37.0	106	· 9 21.0	+147
4	143 31.1	253 02.0	44.4	298 13.2	11.9	63 03.6	38.5	289 01.2	21.4	134 06.6	105	9 35.7	+146
5	158 33.6	268 01.1	44.9	313 14.3	12.4	78 06.4	38.5	304 03.4	21.5	148 36.1	104	9 50.3	+146
6	173 36.0	283 00.2	−21 45.5	328 15.3	− 9 13.0	93 09.3	+22 38.5	319 05.6	−11 21.6	163 05.5	104	+10 04.9	+145
7	188 38.5	297 59.3	46.0	343 16.3	13.5	108 12.1	38.5	334 07.9	21.7	177 34.9	103	10 19.4	+145
8	203 41.0	312 58.5	46.5	358 17.4	14.1	123 14.9	38.4	349 10.1	21.7	192 04.2	102	10 33.9	+145
9	218 43.4	327 57.6	·· 47.0	13 18.4	·· 14.6	138 17.8	·· 38.4	4 12.3	·· 21.8	206 33.4	102	·10 48.4	+143
10	233 45.9	342 56.7	47.5	28 19.4	15.2	153 20.6	38.4	19 14.6	21.9	221 02.6	101	11 02.7	+144
11	248 48.4	357 55.8	48.0	43 20.5	15.7	168 23.4	38.4	34 16.8	21.9	235 31.7	101	11 17.1	+142
12	263 50.8	12 55.0	−21 48.5	58 21.5	− 9 16.3	183 26.3	+22 38.4	49 19.0	−11 22.0	250 00.8	100	+11 31.3	+142
13	278 53.3	27 54.1	49.0	73 22.5	16.8	198 29.1	38.4	64 21.3	22.1	264 29.8	99	11 45.5	+142
14	293 55.7	42 53.2	49.5	88 23.6	17.4	213 31.9	38.3	79 23.5	22.2	278 58.7	98	11 59.7	+140
15	308 58.2	57 52.3	·· 50.0	103 24.6	·· 17.9	228 34.8	·· 38.3	94 25.8	·· 22.2	293 27.5	98	·12 13.7	+141
16	324 00.7	72 51.4	50.5	118 25.6	18.5	243 37.6	38.3	109 28.0	22.3	307 56.3	97	12 27.8	+139
17	339 03.1	87 50.6	51.0	133 26.7	19.0	258 40.4	38.3	124 30.2	22.4	322 25.0	97	12 41.7	+139
18	354 05.6	102 49.7	−21 51.5	148 27.7	− 9 19.6	273 43.3	+22 38.3	139 32.5	−11 22.5	336 53.7	96	+12 55.6	+138
19	9 08.1	117 48.8	52.0	163 28.7	20.1	288 46.1	38.3	154 34.7	22.5	351 22.3	95	13 09.4	+137
20	24 10.5	132 47.9	52.5	178 29.8	20.7	303 48.9	38.2	169 36.9	22.6	5 50.8	94	13 23.1	+137
21	39 13.0	147 47.0	·· 53.0	193 30.8	·· 21.2	318 51.8	·· 38.2	184 39.2	·· 22.7	20 19.2	94	·13 36.8	+136
22	54 15.5	162 46.1	53.5	208 31.8	21.8	333 54.6	38.2	199 41.4	22.7	34 47.6	93	13 50.4	+135
23	69 17.9	177 45.3	54.0	223 32.9	22.3	348 57.4	38.2	214 43.6	22.8	49 15.9	92	14 03.9	+134
16 0	84 20.4	192 44.4	−21 54.5	238 33.9	− 9 22.9	4 00.3	+22 38.2	229 45.9	−11 22.9	63 44.1	92	+14 17.3	+134
1	99 22.9	207 43.5	55.0	253 34.9	23.4	19 03.1	38.2	244 48.1	22.9	78 12.3	91	14 30.7	+132
2	114 25.3	222 42.6	55.5	268 36.0	24.0	34 05.9	38.1	259 50.3	23.0	92 40.4	89	14 43.9	+132
3	129 27.8	237 41.7	·· 56.0	283 37.0	·· 24.5	49 08.8	·· 38.1	274 52.6	·· 23.1	107 08.3	90	·14 57.1	+131
4	144 30.2	252 40.8	56.5	298 38.0	25.1	64 11.6	38.1	289 54.8	23.2	121 36.3	88	15 10.2	+131
5	159 32.7	267 39.9	57.0	313 39.1	25.6	79 14.4	38.1	304 57.0	23.2	136 04.1	88	15 23.3	+129
6	174 35.2	282 39.1	−21 57.4	328 40.1	− 9 26.2	94 17.2	+22 38.1	319 59.3	−11 23.3	150 31.9	87	+15 36.2	+128
7	189 37.6	297 38.2	57.9	343 41.1	26.7	109 20.1	38.1	335 01.5	23.4	164 59.6	86	15 49.0	+128
8	204 40.1	312 37.3	58.4	358 42.2	27.3	124 22.9	38.0	350 03.7	23.4	179 27.2	85	16 01.8	+126
9	219 42.6	327 36.4	·· 58.9	13 43.2	·· 27.8	139 25.7	·· 38.0	5 06.0	·· 23.5	193 54.7	85	·16 14.4	+126
10	234 45.0	342 35.5	59.4	28 44.2	28.4	154 28.6	38.0	20 08.2	23.6	208 22.2	84	16 27.0	+125
11	249 47.5	357 34.6	21 59.9	43 45.3	28.9	169 31.4	38.0	35 10.5	23.7	222 49.6	83	16 39.5	+124
12	264 50.0	12 33.7	−22 00.3	58 46.3	− 9 29.4	184 34.2	+22 38.0	50 12.7	−11 23.7	237 16.9	82	+16 51.9	+122
13	279 52.4	27 32.8	00.8	73 47.3	30.0	199 37.1	38.0	65 14.9	23.8	251 44.1	81	17 04.1	+122
14	294 54.9	42 32.0	01.3	88 48.4	30.5	214 39.9	37.9	80 17.2	23.9	266 11.2	81	17 16.3	+121
15	309 57.4	57 31.1	·· 01.8	103 49.4	·· 31.1	229 42.7	·· 37.9	95 19.4	·· 23.9	280 38.3	80	·17 28.4	+119
16	324 59.8	72 30.2	02.2	118 50.4	31.6	244 45.6	37.9	110 21.6	24.0	295 05.3	79	17 40.3	+119
17	340 02.3	87 29.3	02.7	133 51.5	32.2	259 48.4	37.9	125 23.9	24.1	309 32.2	78	17 52.2	+117
18	355 04.7	102 28.4	−22 03.2	148 52.5	− 9 32.7	274 51.2	+22 37.9	140 26.1	−11 24.2	323 59.0	77	+18 03.9	+117
19	10 07.2	117 27.5	03.7	163 53.5	33.3	289 54.1	37.9	155 28.3	24.2	338 25.7	77	18 15.6	+115
20	25 09.7	132 26.6	04.1	178 54.6	33.8	304 56.9	37.8	170 30.6	24.3	352 52.4	76	18 27.1	+114
21	40 12.1	147 25.7	·· 04.6	193 55.6	·· 34.4	319 59.7	·· 37.8	185 32.8	·· 24.4	7 19.0	75	·18 38.5	+114
22	55 14.6	162 24.8	05.1	208 56.6	34.9	335 02.5	37.8	200 35.1	24.4	21 45.5	74	18 49.9	+111
23	70 17.1	177 23.9	05.5	223 57.7	35.5	350 05.4	37.8	215 37.3	24.5	36 11.9	73	19 01.0	+111
17 0	85 19.5	192 23.0	−22 06.0	238 58.7	− 9 36.0	5 08.2	+22 37.8	230 39.5	−11 24.6	50 38.2	73	+19 12.1	+110
1	100 22.0	207 22.1	06.5	253 59.7	36.5	20 11.0	37.8	245 41.8	24.6	65 04.5	71	19 23.1	+108
2	115 24.5	222 21.2	06.9	269 00.8	37.1	35 13.9	37.7	260 44.0	24.7	79 30.6	71	19 33.9	+107
3	130 26.9	237 20.4	·· 07.4	284 01.8	·· 37.6	50 16.7	·· 37.7	275 46.2	·· 24.8	93 56.7	70	·19 44.6	+106
4	145 29.4	252 19.5	07.9	299 02.8	38.2	65 19.5	37.7	290 48.5	24.9	108 22.7	70	19 55.2	+105
5	160 31.8	267 18.6	08.3	314 03.9	38.7	80 22.4	37.7	305 50.7	24.9	122 48.7	68	20 05.7	+103
6	175 34.3	282 17.7	−22 08.8	329 04.9	− 9 39.3	95 25.2	+22 37.7	320 53.0	−11 25.0	137 14.5	68	+20 16.0	+102
7	190 36.8	297 16.8	09.2	344 05.9	39.8	110 28.0	37.7	335 55.2	25.1	151 40.3	67	20 26.2	+101
8	205 39.2	312 15.9	09.7	359 07.0	40.4	125 30.9	37.6	350 57.4	25.1	166 06.0	66	20 36.3	+100
9	220 41.7	327 15.0	·· 10.2	14 08.0	·· 40.9	140 33.7	·· 37.6	5 59.7	·· 25.2	180 31.6	66	·20 46.3	+ 98
10	235 44.2	342 14.1	10.6	29 09.0	41.5	155 36.5	37.6	21 01.9	25.3	194 57.2	64	20 56.1	+ 97
11	250 46.6	357 13.2	11.1	44 10.1	42.0	170 39.3	37.6	36 04.1	25.3	209 22.6	64	21 05.8	+ 95
12	265 49.1	12 12.3	−22 11.5	59 11.1	− 9 42.5	185 42.2	+22 37.6	51 06.4	−11 25.4	223 48.0	63	+21 15.3	+ 95
13	280 51.6	27 11.4	12.0	74 12.1	43.1	200 45.0	37.6	66 08.6	25.5	238 13.3	63	21 24.8	+ 92
14	295 54.0	42 10.5	12.4	89 13.2	43.6	215 47.8	37.5	81 10.9	25.5	252 38.6	61	21 34.0	+ 92
15	310 56.5	57 09.6	·· 12.9	104 14.2	·· 44.2	230 50.7	·· 37.5	96 13.1	·· 25.6	267 03.7	61	·21 43.2	+ 90
16	325 59.0	72 08.7	13.3	119 15.2	44.7	245 53.5	37.5	111 15.3	25.7	281 28.8	60	21 52.2	+ 88
17	341 01.4	87 07.8	13.8	134 16.3	45.3	260 56.3	37.5	126 17.6	25.8	295 53.8	60	22 01.0	+ 87
18	356 03.9	102 06.9	−22 14.2	149 17.3	− 9 45.8	275 59.2	+22 37.5	141 19.8	−11 25.8	310 18.8	59	+22 09.7	+ 86
19	11 06.3	117 06.0	14.6	164 18.3	46.3	291 02.0	37.5	156 22.1	25.9	324 43.7	58	22 18.3	+ 84
20	26 08.8	132 05.1	15.1	179 19.3	46.9	306 04.8	37.4	171 24.3	26.0	339 08.5	57	22 26.7	+ 83
21	41 11.3	147 04.2	·· 15.5	194 20.4	·· 47.4	321 07.6	·· 37.4	186 26.5	·· 26.0	353 33.2	57	·22 35.0	+ 81
22	56 13.7	162 03.3	16.0	209 21.4	48.0	336 10.5	37.4	201 28.8	26.1	7 57.9	56	22 43.1	+ 80
23	71 16.2	177 02.4	16.4	224 22.4	48.5	351 13.3	37.4	216 31.0	26.2	22 22.5	56	22 51.1	+ 78
24	86 18.7	192 01.5	−22 16.9	239 23.5	− 9 49.1	6 16.1	+22 37.4	231 33.3	−11 26.2	36 47.1	54	+22 58.9	+ 77
code	—	− 9	− 5	+ 10	− 6	+ 29	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
	° ′	° ′
15 h 0	181 16.3	−23 14.8
1	196 16.0	14.9
2	211 15.7	15.0
3	226 15.4 ••	15.2
4	241 15.1	15.3
5	256 14.8	15.5
6	271 14.5	−23 15.6
7	286 14.2	15.7
8	301 13.9	15.9
9	316 13.6 ••	16.0
10	331 13.3	16.1
11	346 13.0	16.3
12	1 12.7	−23 16.4
13	16 12.4	16.5
14	31 12.1	16.6
15	46 11.8 ••	16.8
16	61 11.5	16.9
17	76 11.2	17.0
18	91 10.9	−23 17.2
19	106 10.6	17.3
20	121 10.3	17.4
21	136 10.0 ••	17.5
22	151 09.7	17.6
23	166 09.4	17.8
16 h 0	181 09.1	−23 17.9
1	196 08.8	18.0
2	211 08.5	18.1
3	226 08.2 ••	18.2
4	241 07.9	18.4
5	256 07.6	18.5
6	271 07.3	−23 18.6
7	286 07.0	18.7
8	301 06.7	18.8
9	316 06.4 ••	18.9
10	331 06.1	19.0
11	346 05.8	19.2
12	1 05.5	−23 19.3
13	16 05.2	19.4
14	31 04.9	19.5
15	46 04.6 ••	19.6
16	61 04.3	19.7
17	76 04.0	19.8
18	91 03.7	−23 19.9
19	106 03.4	20.0
20	121 03.1	20.1
21	136 02.8 ••	20.2
22	151 02.4	20.3
23	166 02.1	20.4
17 h 0	181 01.8	−23 20.5
1	196 01.5	20.6
2	211 01.2	20.7
3	226 00.9 ••	20.8
4	241 00.6	20.9
5	256 00.3	21.0
6	271 00.0	−23 21.1
7	285 59.7	21.2
8	300 59.4	21.3
9	315 59.1 ••	21.4
10	330 58.8	21.5
11	345 58.5	21.6
12	0 58.2	−23 21.7
13	15 57.9	21.8
14	30 57.6	21.9
15	45 57.3 ••	22.0
16	60 57.0	22.0
17	75 56.7	22.1
18	90 56.4	−23 22.2
19	105 56.0	22.3
20	120 55.7	22.4
21	135 55.4 ••	22.5
22	150 55.1	22.6
23	165 54.8	22.6
24	180 54.5	−23 22.7
code	—	−1

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.4	−57 28.3
30	Acrux	173 59.6	−62 50.5
19	Adhara	255 47.2	−28 54.4
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.8	+56 12.2
34	Alkaid	153 34.1	+49 32.2
55	Al Na'ir	28 39.8	−47 11.3
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.7	− 8 27.5
41	Alphecca	126 49.1	+26 51.9
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.4	−42 33.5
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.6	+19 25.1
43	Atria	109 03.9	−68 56.8
22	Avior	234 35.9	−59 21.4
13	Bellatrix	279 19.5	+ 6 18.7
16	Betelg'se	271 49.2	+ 7 24.1
17	Canopus	264 15.4	−52 40.1
12	Capella	281 39.9	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.1	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 46.0	+61 59.6
14	Elnath	279 08.7	+28 34.3
47	Eltanin	91 07.4	+51 29.6
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.0	−56 51.2
29	Gienah	176 38.3	−17 17.2
35	Hadar	149 51.9	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.6	+74 20.3
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.6	−36 08.6
24	Miapl'dus	221 48.9	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.2
21	Pollux	244 21.9	+28 08.3
20	Procyon	245 46.1	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.8	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.4	−60 38.7
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.5	+56 17.5
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.5	−10 55.3
23	Suhail	223 25.1	−43 14.6
49	Vega	81 09.6	+38 44.4
39	Zub'g'bl	137 55.1	−15 51.1

GMT	Equation of Time (App.—Mean) 15	16	17
h	m s	m s	m s
0	+ 5 05.9	+ 4 37.1	+ 4 08.0
6	+ 4 58.7	+ 4 29.8	+ 4 00.7
12	+ 4 51.5	+ 4 22.5	+ 3 53.3
18	+ 4 44.3	+ 4 15.3	+ 3 46.0
24	+ 4 37.1	+ 4 08.0	+ 3 38.7

Lat.	Sunrise	Twlt. begins	Moonrise 15	16	17	18
N °	h m	h m	h m	h m	h m	h m
72	■	6 49	10 49	9 50	□	□
70	■	6 41	11 07	10 32	□	□
68	■	6 33	11 21	11 00	10 19	□
66	10 29	6 27	11 33	11 22	11 06	□
64	9 47	6 21	11 43	11 39	11 36	11 33
62	9 19	6 16	11 51	11 54	11 59	12 11
60	8 58	6 12	11 59	12 06	12 17	12 38
58	8 41	6 07	12 05	12 16	12 33	12 59
56	8 26	6 03	12 11	12 26	12 46	13 17
54	8 14	6 00	12 16	12 34	12 58	13 32
52	8 02	5 56	12 21	12 41	13 08	13 44
50	7 53	5 53	12 25	12 48	13 17	13 56
45	7 32	5 44	12 34	13 03	13 37	14 19
40	7 15	5 37	12 42	13 15	13 53	14 39
35	7 01	5 29	12 49	13 25	14 06	14 55
30	6 49	5 23	12 55	13 34	14 18	15 09
20	6 28	5 08	13 05	13 50	14 38	15 32
10	6 09	4 54	13 15	14 03	14 56	15 53
0	5 52	4 36	13 24	14 17	15 13	16 12
10	5 34	4 16	13 32	14 30	15 30	16 32
20	5 16	3 51	13 42	14 44	15 48	16 53
30	4 54	3 17	13 53	15 00	16 09	17 17
35	4 41	2 53	13 59	15 10	16 21	17 32
40	4 26	2 22	14 06	15 21	16 36	17 48
45	4 08	1 36	14 15	15 34	16 53	18 08
50	3 45	////	14 25	15 49	17 14	18 33
52	3 35	////	14 30	15 57	17 24	18 45
54	3 22	////	14 35	16 05	17 35	18 59
56	3 08	////	14 41	16 15	17 48	19 16
58	2 51	////	14 48	16 25	18 03	19 35
60	2 31	////	14 55	16 38	18 22	19 59
S						

Lat.	Sunset	Twlt. ends	Moonset 15	16	17	18
N °	h m	h m	h m	h m	h m	h m
72	■	17 00	3 01	5 50	□	□
70	■	17 09	2 46	5 11	□	□
68	■	17 16	2 34	4 44	7 21	□
66	13 22	17 23	2 24	4 24	6 36	□
64	14 04	17 29	2 16	4 08	6 06	8 11
62	14 32	17 34	2 09	3 54	5 44	7 34
60	14 53	17 39	2 03	3 43	5 26	7 08
58	15 10	17 43	1 58	3 33	5 11	6 47
56	15 25	17 47	1 53	3 25	4 59	6 30
54	15 38	17 51	1 49	3 18	4 48	6 15
52	15 49	17 55	1 45	3 11	4 38	6 03
50	15 59	17 58	1 42	3 05	4 29	5 52
45	16 19	18 06	1 34	2 52	4 11	5 29
40	16 36	18 14	1 28	2 41	3 56	5 10
35	16 50	18 21	1 23	2 32	3 44	4 55
30	17 02	18 27	1 18	2 25	3 33	4 42
20	17 24	18 43	1 10	2 11	3 14	4 19
10	17 42	18 57	1 03	1 59	2 58	3 59
0	17 59	19 14	0 57	1 48	2 43	3 41
10	18 17	19 35	0 50	1 37	2 28	3 23
20	18 36	20 00	0 43	1 26	2 12	3 03
30	18 58	20 35	0 36	1 12	1 54	2 41
35	19 11	20 58	0 31	1 05	1 43	2 28
40	19 26	21 29	0 26	0 56	1 31	2 13
45	19 44	22 17	0 20	0 46	1 17	1 55
50	20 06	////	0 13	0 34	0 59	1 33
52	20 17	////	0 10	0 28	0 51	1 22
54	20 29	////	0 06	0 22	0 42	1 10
56	20 43	////	0 02	0 15	0 32	0 57
58	21 00	////	24 08	0 08	0 21	0 41
60	21 20	////	23 59	24 07	0 07	0 22
S						

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
15	19 36	11 08	8 07	23 44	8 43
16	20 30	11 10	8 05	23 40	8 40
17	21 27	11 11	8 04	23 35	8 36
18	22 27	11 13	8 02	23 31	8 33

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb Add

Alt.	15	16	17
°	′	′	′
0	18.7	18.9	18.7
4	18.7	18.8	18.7
8	18.7	18.8	18.7
12	18.7	18.8	18.7
16	18.6	18.7	18.6
20	18.6	18.7	18.6
24	18.5	18.6	18.5
28	18.4	18.5	18.4
32	18.3	18.4	18.3
36	18.2	18.3	18.2
40	18.1	18.2	18.1
44	18.0	18.1	18.0
48	17.8	17.9	17.8
52	17.7	17.8	17.7
56	17.6	17.6	17.6
60	17.4	17.5	17.4
64	17.2	17.3	17.2
68	17.1	17.1	17.1
72	16.9	17.0	16.9
76	16.8	16.8	16.8
80	16.6	16.6	16.6
84	16.4	16.4	16.4
88	16.3	16.3	16.3
90			

Add to table, back cover

Moon's Upper Limb Subtract

Alt.	15	16	17
°	′	′	′
0	13.7	13.7	13.7
4	13.7	13.7	13.7
8	13.8	13.7	13.8
12	13.8	13.7	13.8
16	13.9	13.8	13.9
20	13.9	13.8	13.9
24	14.0	13.9	14.0
28	14.1	14.0	14.1
32	14.2	14.1	14.2
36	14.3	14.2	14.3
40	14.4	14.3	14.4
44	14.5	14.5	14.5
48	14.6	14.6	14.6
52	14.8	14.7	14.8
56	14.9	14.9	14.9
60	15.1	15.0	15.1
64	15.2	15.2	15.2
68	15.4	15.4	15.4
72	15.5	15.5	15.5
76	15.7	15.7	15.7
80	15.9	15.9	15.9
84	16.1	16.1	16.1
88	16.2	16.2	16.2
90			

Subtract from table, back cover

GMT	♈	VENUS −3.4		MARS 1.7		JUPITER −2.3		SATURN 0.8		MOON			
	GHA	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	Dec.	GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
18 0	86 18.7	192 01.5	−22 16.9	239 23.5	− 9 49.1	6 16.1	+22 37.4	231 33.3	−11 26.2	36 47.1	54	+22 58.9	+ 77
1	101 21.1	207 00.6	17.3	254 24.5	49.6	21 19.0	37.4	246 35.5	26.3	51 11.5	55	23 06.6	+ 75
2	116 23.6	221 59.7	17.7	269 25.5	50.1	36 21.8	37.3	261 37.7	26.4	65 36.0	53	23 14.1	+ 73
3	131 26.1	236 58.8	•• 18.2	284 26.6	•• 50.7	51 24.6	•• 37.3	276 40.0	•• 26.4	80 00.3	53	•23 21.4	+ 73
4	146 28.5	251 57.9	18.6	299 27.6	51.2	66 27.5	37.3	291 42.2	26.5	94 24.6	52	23 28.7	+ 70
5	161 31.0	266 57.0	19.0	314 28.6	51.8	81 30.3	37.3	306 44.5	26.6	108 48.8	52	23 35.7	+ 69
6	176 33.5	281 56.1	−22 19.5	329 29.7	− 9 52.3	96 33.1	+22 37.3	321 46.7	−11 26.7	123 13.0	52	+23 42.6	+ 67
7	191 35.9	296 55.2	19.9	344 30.7	52.9	111 35.9	37.2	336 48.9	26.7	137 37.2	50	23 49.3	+ 66
8	206 38.4	311 54.3	20.3	359 31.7	53.4	126 38.8	37.2	351 51.2	26.8	152 01.2	51	23 55.9	+ 64
9	221 40.8	326 53.4	•• 20.7	14 32.8	•• 53.9	141 41.6	•• 37.2	6 53.4	•• 26.9	166 25.3	49	•24 02.3	+ 62
10	236 43.3	341 52.5	21.2	29 33.8	54.5	156 44.4	37.2	21 55.7	26.9	180 49.2	50	24 08.5	+ 61
11	251 45.8	356 51.5	21.6	44 34.8	55.0	171 47.3	37.2	36 57.9	27.0	195 13.2	48	24 14.6	+ 59
12	266 48.2	11 50.6	−22 22.0	59 35.9	− 9 55.6	186 50.1	+22 37.2	52 00.1	−11 27.1	209 37.0	49	+24 20.5	+ 58
13	281 50.7	26 49.7	22.4	74 36.9	56.1	201 52.9	37.1	67 02.4	27.1	224 00.9	48	24 26.3	+ 56
14	296 53.2	41 48.8	22.9	89 37.9	56.6	216 55.7	37.1	82 04.6	27.2	238 24.7	47	24 31.9	+ 54
15	311 55.6	56 47.9	•• 23.3	104 39.0	•• 57.2	231 58.6	•• 37.1	97 06.9	•• 27.3	252 48.4	47	•24 37.3	+ 52
16	326 58.1	71 47.0	23.7	119 40.0	57.7	247 01.4	37.1	112 09.1	27.3	267 12.1	47	24 42.5	+ 51
17	342 00.6	86 46.1	24.1	134 41.0	58.3	262 04.2	37.1	127 11.4	27.4	281 35.8	46	24 47.6	+ 49
18	357 03.0	101 45.2	−22 24.5	149 42.0	− 9 58.8	277 07.1	+22 37.1	142 13.6	−11 27.5	295 59.4	46	+24 52.5	+ 48
19	12 05.5	116 44.3	25.0	164 43.1	59.3	292 09.9	37.0	157 15.8	27.5	310 23.0	46	24 57.3	+ 45
20	27 08.0	131 43.4	25.4	179 44.1	9 59.9	307 12.7	37.0	172 18.1	27.6	324 46.6	45	25 01.8	+ 45
21	42 10.4	146 42.5	•• 25.8	194 45.1	•10 00.4	322 15.5	•• 37.0	187 20.3	•• 27.7	339 10.1	45	•25 06.3	+ 42
22	57 12.9	161 41.6	26.2	209 46.2	01.0	337 18.4	37.0	202 22.6	27.7	353 33.6	45	25 10.5	+ 40
23	72 15.3	176 40.6	26.6	224 47.2	01.5	352 21.2	37.0	217 24.8	27.8	7 57.1	45	25 14.5	+ 39
19 0	87 17.8	191 39.7	−22 27.0	239 48.2	−10 02.0	7 24.0	+22 37.0	232 27.0	−11 27.9	22 20.6	44	+25 18.4	+ 37
1	102 20.3	206 38.8	27.4	254 49.3	02.6	22 26.9	36.9	247 29.3	28.0	36 44.0	44	25 22.1	+ 36
2	117 22.7	221 37.9	27.9	269 50.3	03.1	37 29.7	36.9	262 31.5	28.0	51 07.4	44	25 25.7	+ 33
3	132 25.2	236 37.0	•• 28.3	284 51.3	•• 03.7	52 32.5	•• 36.9	277 33.8	•• 28.1	65 30.8	44	•25 29.0	+ 32
4	147 27.7	251 36.1	28.7	299 52.4	04.2	67 35.3	36.9	292 36.0	28.2	79 54.2	44	25 32.2	+ 30
5	162 30.1	266 35.2	29.1	314 53.4	04.7	82 38.2	36.9	307 38.3	28.2	94 17.6	43	25 35.2	+ 29
6	177 32.6	281 34.3	−22 29.5	329 54.4	−10 05.3	97 41.0	+22 36.9	322 40.5	−11 28.3	108 40.9	44	+25 38.1	+ 27
7	192 35.1	296 33.4	29.9	344 55.4	05.8	112 43.8	36.8	337 42.7	28.4	123 04.3	43	25 40.8	+ 24
8	207 37.5	311 32.4	30.3	359 56.5	06.4	127 46.6	36.8	352 45.0	28.4	137 27.6	44	25 43.2	+ 24
9	222 40.0	326 31.5	•• 30.7	14 57.5	•• 06.9	142 49.5	•• 36.8	7 47.2	•• 28.5	151 51.0	43	•25 45.6	+ 21
10	237 42.4	341 30.6	31.1	29 58.5	07.4	157 52.3	36.8	22 49.5	28.6	166 14.3	44	25 47.7	+ 20
11	252 44.9	356 29.7	31.5	44 59.6	08.0	172 55.1	36.8	37 51.7	28.6	180 37.7	43	25 49.7	+ 17
12	267 47.4	11 28.8	−22 31.9	60 00.6	−10 08.5	187 58.0	+22 36.8	52 54.0	−11 28.7	195 01.0	44	+25 51.4	+ 17
13	282 49.8	26 27.9	32.3	75 01.6	09.1	203 00.8	36.7	67 56.2	28.8	209 24.4	43	25 53.1	+ 14
14	297 52.3	41 27.0	32.7	90 02.7	09.6	218 03.6	36.7	82 58.5	28.8	223 47.7	44	25 54.5	+ 12
15	312 54.8	56 26.0	•• 33.1	105 03.7	•• 10.1	233 06.4	•• 36.7	98 00.7	•• 28.9	238 11.1	44	•25 55.7	+ 11
16	327 57.2	71 25.1	33.4	120 04.7	10.7	248 09.3	36.7	113 02.9	29.0	252 34.5	44	25 56.8	+ 9
17	342 59.7	86 24.2	33.8	135 05.8	11.2	263 12.1	36.7	128 05.2	29.0	266 57.9	44	25 57.7	+ 8
18	358 02.2	101 23.3	−22 34.2	150 06.8	−10 11.7	278 14.9	+22 36.6	143 07.4	−11 29.1	281 21.3	44	+25 58.5	+ 5
19	13 04.6	116 22.4	34.6	165 07.8	12.3	293 17.7	36.6	158 09.7	29.2	295 44.7	45	25 59.0	+ 4
20	28 07.1	131 21.5	35.0	180 08.8	12.8	308 20.6	36.6	173 11.9	29.2	310 08.2	44	25 59.4	+ 2
21	43 09.6	146 20.5	•• 35.4	195 09.9	•• 13.4	323 23.4	•• 36.6	188 14.2	•• 29.3	324 31.6	46	•25 59.6	0
22	58 12.0	161 19.6	35.8	210 10.9	13.9	338 26.2	36.6	203 16.4	29.4	338 55.2	45	25 59.6	− 1
23	73 14.5	176 18.7	36.2	225 11.9	14.4	353 29.1	36.6	218 18.6	29.4	353 18.7	46	25 59.5	− 3
20 0	88 16.9	191 17.8	−22 36.5	240 13.0	−10 15.0	8 31.9	+22 36.5	233 20.9	−11 29.5	7 42.3	45	+25 59.2	− 5
1	103 19.4	206 16.9	36.9	255 14.0	15.5	23 34.7	36.5	248 23.1	29.6	22 05.8	47	25 58.7	− 7
2	118 21.9	221 16.0	37.3	270 15.0	16.0	38 37.5	36.5	263 25.4	29.6	36 29.5	47	25 58.0	− 8
3	133 24.3	236 15.0	•• 37.7	285 16.1	•• 16.6	53 40.4	•• 36.5	278 27.6	•• 29.7	50 53.2	47	•25 57.2	− 10
4	148 26.8	251 14.1	38.1	300 17.1	17.1	68 43.2	36.5	293 29.9	29.8	65 16.9	47	25 56.2	− 12
5	163 29.3	266 13.2	38.4	315 18.1	17.6	83 46.0	36.5	308 32.1	29.8	79 40.6	48	25 55.0	− 13
6	178 31.7	281 12.3	−22 38.8	330 19.2	−10 18.2	98 48.8	+22 36.4	323 34.4	−11 29.9	94 04.4	49	+25 53.7	− 15
7	193 34.2	296 11.4	39.2	345 20.2	18.7	113 51.7	36.4	338 36.6	30.0	108 28.3	49	25 52.2	− 17
8	208 36.7	311 10.4	39.6	0 21.2	19.2	128 54.5	36.4	353 38.9	30.0	122 52.2	49	25 50.5	− 19
9	223 39.1	326 09.5	•• 39.9	15 22.2	•• 19.8	143 57.3	•• 36.4	8 41.1	•• 30.1	137 16.1	50	•25 48.6	− 20
10	238 41.6	341 08.6	40.3	30 23.3	20.3	159 00.1	36.4	23 43.3	30.2	151 40.1	50	25 46.6	− 22
11	253 44.1	356 07.7	40.7	45 24.3	20.9	174 03.0	36.4	38 45.6	30.2	166 04.1	52	25 44.4	− 23
12	268 46.5	11 06.7	−22 41.0	60 25.3	−10 21.4	189 05.8	+22 36.3	53 47.8	−11 30.3	180 28.3	51	+25 42.1	− 26
13	283 49.0	26 05.8	41.4	75 26.4	21.9	204 08.6	36.3	68 50.1	30.4	194 52.4	52	25 39.5	− 26
14	298 51.4	41 04.9	41.8	90 27.4	22.5	219 11.4	36.3	83 52.3	30.4	209 16.6	53	25 36.9	− 29
15	313 53.9	56 04.0	•• 42.1	105 28.4	•• 23.0	234 14.3	•• 36.3	98 54.6	•• 30.5	223 40.9	54	•25 34.0	− 30
16	328 56.4	71 03.1	42.5	120 29.5	23.5	249 17.1	36.3	113 56.8	30.6	238 05.3	54	25 31.0	− 32
17	343 58.8	86 02.1	42.9	135 30.5	24.1	264 19.9	36.3	128 59.1	30.6	252 29.7	55	25 27.8	− 33
18	359 01.3	101 01.2	−22 43.2	150 31.5	−10 24.6	279 22.7	+22 36.2	144 01.3	−11 30.7	266 54.2	56	+25 24.5	− 35
19	14 03.8	116 00.3	43.6	165 32.5	25.1	294 25.6	36.2	159 03.6	30.8	281 18.8	56	25 21.0	− 36
20	29 06.2	130 59.4	43.9	180 33.6	25.7	309 28.4	36.2	174 05.8	30.8	295 43.4	57	25 17.4	− 38
21	44 08.7	145 58.4	•• 44.3	195 34.6	•• 26.2	324 31.2	•• 36.2	189 08.1	•• 30.9	310 08.1	58	•25 13.6	− 40
22	59 11.2	160 57.5	44.7	210 35.6	26.7	339 34.0	36.2	204 10.3	31.0	324 32.9	58	25 09.6	− 41
23	74 13.6	175 56.6	45.0	225 36.7	27.3	354 36.9	36.1	219 12.6	31.0	338 57.7	60	25 05.5	− 43
24	89 16.1	190 55.7	−22 45.4	240 37.7	−10 27.8	9 39.7	+22 36.1	234 14.8	−11 31.1	353 22.7	60	+25 01.2	− 44
code	—	− 9	− 4	+ 10	− 6	+ 28	− 1	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
18 h 0	180 54.5	−23 22.7
1	195 54.2	22.8
2	210 53.9	22.9
3	225 53.6	23.0
4	240 53.3	23.0
5	255 53.0	23.1
6	270 52.7	−23 23.2
7	285 52.4	23.3
8	300 52.1	23.3
9	315 51.8	23.4
10	330 51.5	23.5
11	345 51.1	23.6
12	0 50.8	−23 23.6
13	15 50.5	23.7
14	30 50.2	23.8
15	45 49.9	23.8
16	60 49.6	23.9
17	75 49.3	24.0
18	90 49.0	−23 24.0
19	105 48.7	24.1
20	120 48.4	24.2
21	135 48.1	24.2
22	150 47.8	24.3
23	165 47.5	24.4
19 h 0	180 47.1	−23 24.4
1	195 46.8	24.5
2	210 46.5	24.6
3	225 46.2	24.6
4	240 45.9	24.7
5	255 45.6	24.7
6	270 45.3	−23 24.8
7	285 45.0	24.8
8	300 44.7	24.9
9	315 44.4	25.0
10	330 44.1	25.0
11	345 43.8	25.1
12	0 43.5	−23 25.1
13	15 43.1	25.2
14	30 42.8	25.2
15	45 42.5	25.3
16	60 42.2	25.3
17	75 41.9	25.4
18	90 41.6	−23 25.4
19	105 41.3	25.5
20	120 41.0	25.5
21	135 40.7	25.5
22	150 40.4	25.6
23	165 40.1	25.6
20 h 0	180 39.8	−23 25.7
1	195 39.4	25.7
2	210 39.1	25.8
3	225 38.8	25.8
4	240 38.5	25.8
5	255 38.2	25.9
6	270 37.9	−23 25.9
7	285 37.6	26.0
8	300 37.3	26.0
9	315 37.0	26.0
10	330 36.7	26.1
11	345 36.4	26.1
12	0 36.0	−23 26.1
13	15 35.7	26.2
14	30 35.4	26.2
15	45 35.1	26.2
16	60 34.8	26.2
17	75 34.5	26.3
18	90 34.2	−23 26.3
19	105 33.9	26.3
20	120 33.6	26.4
21	135 33.3	26.4
22	150 32.9	26.4
23	165 32.6	26.4
24	180 32.3	−23 26.5
code	−	−1

STARS No.	Name	SHA	Dec.
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.4	−57 28.3
30	Acrux	173 59.6	−62 50.5
19	Adhara	255 47.2	−28 54.4
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.8	+56 12.2
34	Alkaid	153 34.1	+49 32.2
55	Al Na'ir	28 39.8	−47 11.3
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.7	− 8 27.5
41	Alphecca	126 49.1	+26 51.9
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.8
2	Ankaa	353 59.5	−42 33.5
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.6	+19 25.1
43	Atria	109 03.9	−68 56.8
22	Avior	234 35.9	−59 21.5
13	Bellatrix	279 19.5	+ 6 18.7
16	Betelg'se	271 49.2	+ 7 24.1
17	Canopus	264 15.4	−52 40.1
12	Capella	281 39.9	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.1	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 45.9	+61 59.6
14	Elnath	279 08.6	+28 34.3
47	Eltanin	91 07.4	+51 29.6
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.1	−29 52.1
31	Gacrux	172 51.0	−56 51.2
29	Gienah	176 38.3	−17 17.2
35	Hadar	149 51.8	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.4	−34 24.6
40	Kochab	137 18.5	+74 20.3
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.5	−36 08.6
24	Miapl'dus	221 48.9	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.2
21	Pollux	244 21.9	+28 08.3
20	Procyon	245 46.1	+ 5 20.7
46	R'alhague	96 48.2	+12 35.5
26	Regulus	208 30.8	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.4	−60 38.7
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.5	+56 17.5
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.4	−10 55.3
23	Suhail	223 25.1	−43 14.6
49	Vega	81 09.6	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.1

Lat.	Sunrise	Twlt. begins	Moonrise 18	19	20	21
N 72	■	6 52	□	□	□	□
70	■	6 43	□	□	□	□
68	■	6 36	□	□	□	□
66	10 33	6 30	□	□	□	13 38
64	9 51	6 24	11 33	11 36	12 47	14 47
62	9 22	6 19	12 11	12 41	13 48	15 23
60	9 01	6 14	12 38	13 16	14 22	15 48
58	8 43	6 09	12 59	13 42	14 47	16 08
56	8 28	6 06	13 17	14 02	15 07	16 25
54	8 16	6 02	13 32	14 19	15 23	16 39
52	8 05	5 58	13 44	14 34	15 37	16 51
50	7 55	5 54	13 56	14 46	15 50	17 02
45	7 34	5 46	14 19	15 12	16 15	17 25
40	7 17	5 39	14 39	15 33	16 36	17 43
35	7 03	5 31	14 55	15 50	16 53	17 58
30	6 51	5 24	15 09	16 05	17 07	18 11
20	6 29	5 10	15 32	16 31	17 32	18 33
10	6 11	4 55	15 53	16 53	17 54	18 53
0	5 53	4 38	16 12	17 13	18 14	19 11
10	5 36	4 17	16 32	17 34	18 34	19 29
20	5 17	3 52	16 53	17 56	18 55	19 48
30	4 55	3 17	17 17	18 22	19 20	20 10
35	4 42	2 54	17 32	18 37	19 34	20 23
40	4 27	2 23	17 48	18 54	19 51	20 38
45	4 09	1 35	18 08	19 15	20 11	20 55
50	3 46	////	18 33	19 42	20 37	21 17
52	3 35	////	18 45	19 55	20 49	21 27
54	3 23	////	18 59	20 10	21 03	21 39
56	3 09	////	19 16	20 27	21 19	21 52
58	2 52	////	19 35	20 48	21 38	22 08
60	2 31	////	19 59	21 15	22 02	22 26
S						

Lat.	Sunset	Twlt. ends	Moonset 18	19	20	21
N 72	■	17 00	□	□	□	□
70	■	17 10	□	□	□	□
68	■	17 17	□	□	□	□
66	13 21	17 24	□	□	□	12 24
64	14 03	17 29	8 11	10 16	11 13	11 14
62	14 32	17 35	7 34	9 11	10 11	10 38
60	14 53	17 39	7 08	8 36	9 37	10 12
58	15 11	17 44	6 47	8 11	9 12	9 52
56	15 26	17 48	6 30	7 50	8 52	9 34
54	15 38	17 52	6 15	7 34	8 36	9 20
52	15 49	17 55	6 03	7 19	8 21	9 07
50	15 59	17 59	5 52	7 07	8 09	8 56
45	16 20	18 07	5 29	6 41	7 43	8 33
40	16 37	18 15	5 10	6 20	7 22	8 14
35	16 51	18 22	4 55	6 03	7 05	7 58
30	17 04	18 30	4 42	5 48	6 50	7 44
20	17 25	18 44	4 19	5 23	6 25	7 21
10	17 43	18 58	3 59	5 02	6 03	7 01
0	18 01	19 16	3 41	4 41	5 42	6 41
10	18 18	19 36	3 23	4 21	5 22	6 22
20	18 37	20 01	3 03	4 00	5 00	6 02
30	18 59	20 36	2 41	3 35	4 34	5 38
35	19 12	20 59	2 28	3 20	4 19	5 24
40	19 27	21 30	2 13	3 03	4 02	5 07
45	19 45	22 18	1 55	2 42	3 41	4 47
50	20 08	////	1 33	2 17	3 14	4 23
52	20 19	////	1 22	2 04	3 01	4 11
54	20 31	////	1 10	1 50	2 46	3 57
56	20 46	////	0 57	1 34	2 29	3 41
58	21 02	////	0 41	1 14	2 08	3 22
60	21 23	////	0 22	0 49	1 41	2 59
S						

GMT	Equation of Time (App.—Mean) 18	19	20
0	+ 3 38.7	+ 3 09.2	+ 2 39.6
6	+ 3 31.3	+ 3 01.8	+ 2 32.2
12	+ 3 24.0	+ 2 54.4	+ 2 24.8
18	+ 3 16.6	+ 2 47.0	+ 2 17.4
24	+ 3 09.2	+ 2 39.6	+ 2 09.9

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
18	22 27	11 13	8 02	23 31	8 33
19	23 28	11 14	8 00	23 26	8 29
20	24 28	11 16	7 59	23 22	8 25
21	0 28	11 17	7 57	23 17	8 22

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	18	19	20
°	′	′	′
0	18.5	18.0	17.3
4	18.5	18.0	17.3
8	18.4	17.9	17.3
12	18.4	17.9	17.3
16	18.4	17.9	17.3
20	18.3	17.8	17.2
24	18.2	17.8	17.2
28	18.2	17.7	17.1
32	18.1	17.6	17.1
36	18.0	17.6	17.0
40	17.9	17.5	17.0
44	17.8	17.4	16.9
48	17.7	17.3	16.8
52	17.5	17.2	16.8
56	17.4	17.1	16.7
60	17.3	17.0	16.6
64	17.1	16.8	16.5
68	17.0	16.7	16.4
72	16.8	16.6	16.3
76	16.7	16.5	16.2
80	16.5	16.3	16.1
84	16.3	16.2	16.0
88	16.2	16.1	16.0
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	18	19	20
°	′	′	′
0	13.9	14.2	14.5
4	13.9	14.2	14.5
8	13.9	14.2	14.6
12	13.9	14.2	14.6
16	14.0	14.3	14.6
20	14.0	14.3	14.6
24	14.1	14.4	14.7
28	14.2	14.4	14.7
32	14.3	14.5	14.8
36	14.4	14.6	14.8
40	14.5	14.7	14.9
44	14.6	14.7	15.0
48	14.7	14.8	15.0
52	14.8	15.0	15.1
56	15.0	15.1	15.2
60	15.1	15.2	15.3
64	15.2	15.3	15.4
68	15.4	15.4	15.5
72	15.5	15.5	15.5
76	15.7	15.7	15.6
80	15.9	15.8	15.7
84	16.0	15.9	15.8
88	16.1	16.0	15.9
90			

Subtract from table, back cover

Full Moon 20

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.7 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
21 0	89 16.1	190 55.7	−22 45.4	240 37.7	−10 27.8	9 39.7	+22 36.1	234 14.8	−11 31.1	353 22.7	60	+25 01.2	− 44
1	104 18.6	205 54.7	45.7	255 38.7	28.3	24 42.5	36.1	249 17.0	31.2	7 47.7	61	24 56.8	− 46
2	119 21.0	220 53.8	46.1	270 39.7	28.9	39 45.3	36.1	264 19.3	31.2	22 12.8	61	24 52.2	− 47
3	134 23.5	235 52.9	•• 46.4	285 40.8	•• 29.4	54 48.2	•• 36.1	279 21.5	•• 31.3	36 37.9	63	•24 47.5	− 49
4	149 25.9	250 52.0	46.8	300 41.8	29.9	69 51.0	36.1	294 23.8	31.4	51 03.2	64	24 42.6	− 50
5	164 28.4	265 51.0	47.1	315 42.8	30.5	84 53.8	36.0	309 26.0	31.4	65 28.6	64	24 37.6	− 52
6	179 30.9	280 50.1	−22 47.5	330 43.9	−10 31.0	99 56.6	+22 36.0	324 28.3	−11 31.5	79 54.0	65	+24 32.4	− 53
7	194 33.3	295 49.2	47.8	345 44.9	31.5	114 59.5	36.0	339 30.5	31.6	94 19.5	66	24 27.1	− 55
8	209 35.8	310 48.2	48.2	0 45.9	32.1	130 02.3	36.0	354 32.8	31.6	108 45.1	67	24 21.6	− 56
9	224 38.3	325 47.3	•• 48.5	15 47.0	•• 32.6	145 05.1	•• 36.0	9 35.0	•• 31.7	123 10.8	68	•24 16.0	− 57
10	239 40.7	340 46.4	48.8	30 48.0	33.1	160 07.9	36.0	24 37.3	31.8	137 36.6	69	24 10.3	− 59
11	254 43.2	355 45.5	49.2	45 49.0	33.7	175 10.7	35.9	39 39.5	31.8	152 02.5	70	24 04.4	− 60
12	269 45.7	10 44.5	−22 49.5	60 50.0	−10 34.2	190 13.6	+22 35.9	54 41.8	−11 31.9	166 28.5	71	+23 58.4	− 62
13	284 48.1	25 43.6	49.9	75 51.1	34.7	205 16.4	35.9	69 44.0	31.9	180 54.6	71	23 52.2	− 63
14	299 50.6	40 42.7	50.2	90 52.1	35.3	220 19.2	35.9	84 46.3	32.0	195 20.7	73	23 45.9	− 64
15	314 53.1	55 41.7	•• 50.5	105 53.1	•• 35.8	235 22.0	•• 35.9	99 48.5	•• 32.1	209 47.0	74	•23 39.5	− 65
16	329 55.5	70 40.8	50.9	120 54.2	36.3	250 24.9	35.9	114 50.8	32.1	224 13.4	74	23 33.0	− 67
17	344 58.0	85 39.9	51.2	135 55.2	36.9	265 27.7	35.8	129 53.0	32.2	238 39.8	76	23 26.3	− 69
18	0 00.4	100 38.9	−22 51.5	150 56.2	−10 37.4	280 30.5	+22 35.8	144 55.3	−11 32.3	253 06.4	77	+23 19.4	− 69
19	15 02.9	115 38.0	51.9	165 57.2	37.9	295 33.3	35.8	159 57.5	32.3	267 33.1	77	23 12.5	− 71
20	30 05.4	130 37.1	52.2	180 58.3	38.4	310 36.2	35.8	174 59.8	32.4	281 59.8	79	23 05.4	− 72
21	45 07.8	145 36.1	•• 52.5	195 59.3	•• 39.0	325 39.0	•• 35.8	190 02.0	•• 32.5	296 26.7	79	•22 58.2	− 73
22	60 10.3	160 35.2	52.9	211 00.3	39.5	340 41.8	35.7	205 04.3	32.5	310 53.6	81	22 50.9	− 75
23	75 12.8	175 34.3	53.2	226 01.4	40.0	355 44.6	35.7	220 06.5	32.6	325 20.7	82	22 43.4	− 76
22 0	90 15.2	190 33.3	−22 53.5	241 02.4	−10 40.6	10 47.4	+22 35.7	235 08.8	−11 32.7	339 47.9	83	+22 35.8	− 77
1	105 17.7	205 32.4	53.8	256 03.4	41.1	25 50.3	35.7	250 11.0	32.7	354 15.2	83	22 28.1	− 78
2	120 20.2	220 31.5	54.2	271 04.4	41.6	40 53.1	35.7	265 13.3	32.8	8 42.5	85	22 20.3	− 79
3	135 22.6	235 30.5	•• 54.5	286 05.5	•• 42.2	55 55.9	•• 35.7	280 15.5	•• 32.9	23 10.0	86	•22 12.4	− 81
4	150 25.1	250 29.6	54.8	301 06.5	42.7	70 58.7	35.6	295 17.8	32.9	37 37.6	87	22 04.3	− 81
5	165 27.5	265 28.7	55.1	316 07.5	43.2	86 01.5	35.6	310 20.0	33.0	52 05.3	88	21 56.2	− 83
6	180 30.0	280 27.7	−22 55.4	331 08.6	−10 43.7	101 04.4	+22 35.6	325 22.3	−11 33.0	66 33.1	89	+21 47.9	− 84
7	195 32.5	295 26.8	55.8	346 09.6	44.3	116 07.2	35.6	340 24.5	33.1	81 01.0	90	21 39.5	− 85
8	210 34.9	310 25.9	56.1	1 10.6	44.8	131 10.0	35.6	355 26.8	33.2	95 29.0	91	21 31.0	− 86
9	225 37.4	325 24.9	•• 56.4	16 11.6	•• 45.3	146 12.8	•• 35.6	10 29.0	•• 33.2	109 57.1	93	•21 22.4	− 87
10	240 39.9	340 24.0	56.7	31 12.7	45.9	161 15.7	35.5	25 31.3	33.3	124 25.4	93	21 13.7	− 88
11	255 42.3	355 23.1	57.0	46 13.7	46.4	176 18.5	35.5	40 33.5	33.4	138 53.7	94	21 04.9	− 89
12	270 44.8	10 22.1	−22 57.3	61 14.7	−10 46.9	191 21.3	+22 35.5	55 35.8	−11 33.4	153 22.1	96	+20 56.0	− 90
13	285 47.3	25 21.2	57.6	76 15.8	47.5	206 24.1	35.5	70 38.0	33.5	167 50.7	96	20 47.0	− 92
14	300 49.7	40 20.3	57.9	91 16.8	48.0	221 26.9	35.5	85 40.3	33.6	182 19.3	97	20 37.8	− 92
15	315 52.2	55 19.3	•• 58.2	106 17.8	•• 48.5	236 29.8	•• 35.4	100 42.5	•• 33.6	196 48.0	99	•20 28.6	− 93
16	330 54.7	70 18.4	58.5	121 18.8	49.0	251 32.6	35.4	115 44.8	33.7	211 16.9	100	20 19.3	− 94
17	345 57.1	85 17.5	58.9	136 19.9	49.6	266 35.4	35.4	130 47.0	33.8	225 45.9	100	20 09.9	− 95
18	0 59.6	100 16.5	−22 59.2	151 20.9	−10 50.1	281 38.2	+22 35.4	145 49.3	−11 33.8	240 14.9	102	+20 00.4	− 96
19	16 02.0	115 15.6	59.5	166 21.9	50.6	296 41.0	35.4	160 51.5	33.9	254 44.1	103	19 50.8	− 97
20	31 04.5	130 14.6	22 59.8	181 23.0	51.1	311 43.9	35.4	175 53.8	33.9	269 13.4	104	19 41.1	− 98
21	46 07.0	145 13.7	•23 00.1	196 24.0	•• 51.7	326 46.7	•• 35.3	190 56.0	•• 34.0	283 42.8	105	•19 31.3	− 99
22	61 09.4	160 12.8	00.4	211 25.0	52.2	341 49.5	35.3	205 58.3	34.1	298 12.3	105	19 21.4	− 99
23	76 11.9	175 11.8	00.7	226 26.0	52.7	356 52.3	35.3	221 00.6	34.1	312 41.8	107	19 11.5	−101
23 0	91 14.4	190 10.9	−23 01.0	241 27.1	−10 53.3	11 55.1	+22 35.3	236 02.8	−11 34.2	327 11.5	108	+19 01.4	−101
1	106 16.8	205 09.9	01.2	256 28.1	53.8	26 58.0	35.3	251 05.1	34.3	341 41.3	109	18 51.3	−102
2	121 19.3	220 09.0	01.5	271 29.1	54.3	42 00.8	35.3	266 07.3	34.3	356 11.2	110	18 41.1	−103
3	136 21.8	235 08.1	•• 01.8	286 30.2	•• 54.8	57 03.6	•• 35.2	281 09.6	•• 34.4	10 41.2	111	•18 30.8	−104
4	151 24.2	250 07.1	02.1	301 31.2	55.4	72 06.4	35.2	296 11.8	34.5	25 11.3	113	18 20.4	−105
5	166 26.7	265 06.2	02.4	316 32.2	55.9	87 09.2	35.2	311 14.1	34.5	39 41.6	113	18 09.9	−105
6	181 29.2	280 05.2	−23 02.7	331 33.2	−10 56.4	102 12.1	+22 35.2	326 16.3	−11 34.6	54 11.9	114	+17 59.4	−106
7	196 31.6	295 04.3	03.0	346 34.3	56.9	117 14.9	35.2	341 18.6	34.6	68 42.3	115	17 48.8	−107
8	211 34.1	310 03.4	03.3	1 35.3	57.5	132 17.7	35.2	356 20.8	34.7	83 12.8	116	17 38.1	−108
9	226 36.5	325 02.4	•• 03.6	16 36.3	•• 58.0	147 20.5	•• 35.1	11 23.1	•• 34.8	97 43.4	117	•17 27.3	−108
10	241 39.0	340 01.5	03.9	31 37.3	58.5	162 23.3	35.1	26 25.3	34.8	112 14.1	118	17 16.5	−109
11	256 41.5	355 00.5	04.1	46 38.4	59.0	177 26.1	35.1	41 27.6	34.9	126 44.9	119	17 05.6	−110
12	271 43.9	9 59.6	−23 04.4	61 39.4	−10 59.6	192 29.0	+22 35.1	56 29.8	−11 35.0	141 15.8	120	+16 54.6	−110
13	286 46.4	24 58.6	04.7	76 40.4	11 00.1	207 31.8	35.1	71 32.1	35.0	155 46.8	121	16 43.6	−111
14	301 48.9	39 57.7	05.0	91 41.5	00.6	222 34.6	35.0	86 34.4	35.1	170 17.9	122	16 32.5	−112
15	316 51.3	54 56.8	•• 05.3	106 42.5	•• 01.2	237 37.4	•• 35.0	101 36.6	•• 35.2	184 49.1	123	•16 21.3	−112
16	331 53.8	69 55.8	05.5	121 43.5	01.7	252 40.2	35.0	116 38.9	35.2	199 20.4	124	16 10.1	−113
17	346 56.3	84 54.9	05.8	136 44.5	02.2	267 43.1	35.0	131 41.1	35.3	213 51.8	124	15 58.8	−114
18	1 58.7	99 53.9	−23 06.1	151 45.6	−11 02.7	282 45.9	+22 35.0	146 43.4	−11 35.3	228 23.2	126	+15 47.4	−114
19	17 01.2	114 53.0	06.4	166 46.6	03.3	297 48.7	35.0	161 45.6	35.4	242 54.8	127	15 36.0	−115
20	32 03.7	129 52.0	06.6	181 47.6	03.8	312 51.5	34.9	176 47.9	35.5	257 26.5	127	15 24.5	−115
21	47 06.1	144 51.1	•• 06.9	196 48.6	•• 04.3	327 54.3	•• 34.9	191 50.1	•• 35.5	271 58.2	128	•15 13.0	−116
22	62 08.6	159 50.2	07.2	211 49.7	04.8	342 57.1	34.9	206 52.4	35.6	286 30.0	130	15 01.4	−117
23	77 11.0	174 49.2	07.4	226 50.7	05.3	358 00.0	34.9	221 54.6	35.7	301 02.0	130	14 49.7	−117
24	92 13.5	189 48.3	−23 07.7	241 51.7	−11 05.9	13 02.8	+22 34.9	236 56.9	−11 35.7	315 34.0	131	+14 38.0	−117
code	—	− 9	− 3	+ 11	− 6	+ 28	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
21 0	180 32.3	−23 26.5
1	195 32.0	26.5
2	210 31.7	26.5
3	225 31.4	26.5
4	240 31.1	26.5
5	255 30.8	26.6
6	270 30.5	−23 26.6
7	285 30.2	26.6
8	300 29.8	26.6
9	315 29.5	26.6
10	330 29.2	26.6
11	345 28.9	26.7
12	0 28.6	−23 26.7
13	15 28.3	26.7
14	30 28.0	26.7
15	45 27.7	26.7
16	60 27.4	26.7
17	75 27.1	26.7
18	90 26.7	−23 26.7
19	105 26.4	26.7
20	120 26.1	26.7
21	135 25.8	26.7
22	150 25.5	26.8
23	165 25.2	26.8
22 0	180 24.9	−23 26.8
1	195 24.6	26.8
2	210 24.3	26.8
3	225 24.0	26.8
4	240 23.6	26.8
5	255 23.3	26.8
6	270 23.0	−23 26.8
7	285 22.7	26.8
8	300 22.4	26.8
9	315 22.1	26.8
10	330 21.8	26.8
11	345 21.5	26.7
12	0 21.2	−23 26.7
13	15 20.9	26.7
14	30 20.5	26.7
15	45 20.2	26.7
16	60 19.9	26.7
17	75 19.6	26.7
18	90 19.3	−23 26.7
19	105 19.0	26.7
20	120 18.7	26.7
21	135 18.4	26.6
22	150 18.1	26.6
23	165 17.7	26.6
23 0	180 17.4	−23 26.6
1	195 17.1	26.6
2	210 16.8	26.6
3	225 16.5	26.5
4	240 16.2	26.5
5	255 15.9	26.5
6	270 15.6	−23 26.5
7	285 15.3	26.5
8	300 14.9	26.4
9	315 14.6	26.4
10	330 14.3	26.4
11	345 14.0	26.4
12	0 13.7	−23 26.3
13	15 13.4	26.3
14	30 13.1	26.3
15	45 12.8	26.3
16	60 12.5	26.2
17	75 12.2	26.2
18	90 11.8	−23 26.2
19	105 11.5	26.1
20	120 11.2	26.1
21	135 10.9	26.1
22	150 10.6	26.0
23	165 10.3	26.0
24	180 10.0	−23 26.0
code	—	0

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.7	−40 29.3
5	Achernar	335 59.4	−57 28.3
30	Acrux	173 59.5	−62 50.5
19	Adhara	255 47.2	−28 54.4
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.7	+56 12.2
34	Alkaid	153 34.1	+49 32.2
55	Al Na'ir	28 39.8	−47 11.2
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.7	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.7
2	Ankaa	353 59.5	−42 33.5
42	Antares	113 21.4	−26 19.9
37	Arcturus	146 36.6	+19 25.1
43	Atria	109 03.9	−68 56.8
22	Avior	234 35.9	−59 21.5
13	Bellatrix	279 19.5	+ 6 18.7
16	Betelg'se	271 49.2	+ 7 24.1
17	Canopus	264 15.4	−52 40.1
12	Capella	281 39.9	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.0	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 45.9	+61 59.6
14	Elnath	279 08.6	+28 34.3
47	Eltanin	91 07.4	+51 29.6
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.2	−29 52.1
31	Gacrux	172 50.9	−56 51.2
29	Gienah	176 38.3	−17 17.2
35	Hadar	149 51.8	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.5	+74 20.3
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.8
36	Menkent	149 00.5	−36 08.6
24	Miapl'dus	221 48.8	−69 31.4
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.2
21	Pollux	244 21.8	+28 08.3
20	Procyon	245 46.1	+ 5 20.7
46	R'alhague	96 48.2	+12 35.4
26	Regulus	208 30.7	+12 11.5
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.3	−60 38.7
44	Sabik	103 04.1	−15 40.2
3	Schedar	350 31.5	+56 17.5
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.4	−10 55.4
23	Suhail	223 25.0	−43 14.6
49	Vega	81 09.6	+38 44.4
39	Zub'g'bl	137 55.1	−15 51.1

GMT	Equation of Time (App.—Mean) 21	22	23
h	m s	m s	m s
0	+ 2 09.9	+ 1 40.2	+ 1 10.4
6	+ 2 02.5	+ 1 32.7	+ 1 02.9
12	+ 1 55.1	+ 1 25.3	+ 0 55.4
18	+ 1 47.6	+ 1 17.8	+ 0 48.0
24	+ 1 40.2	+ 1 10.4	+ 0 40.5

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 21 h m	22 h m	23 h m	24 h m
72	▬	6 54	▭	▭	16 38	19 11
70	▬	6 46	▭	▭	17 21	19 30
68	▬	6 38	▭	15 29	17 50	19 44
66	10 35	6 32	13 38	16 13	18 11	19 56
64	9 52	6 26	14 47	16 42	18 28	20 05
62	9 24	6 20	15 23	17 04	18 42	20 14
60	9 02	6 16	15 48	17 22	18 53	20 21
58	8 45	6 11	16 08	17 36	19 04	20 27
56	8 30	6 07	16 25	17 49	19 12	20 32
54	8 17	6 03	16 39	18 00	19 20	20 37
52	8 06	6 00	16 51	18 09	19 27	20 41
50	7 56	5 56	17 02	18 18	19 33	20 45
45	7 35	5 48	17 25	18 36	19 46	20 54
40	7 18	5 40	17 43	18 51	19 57	21 01
35	7 04	5 33	17 58	19 03	20 07	21 07
30	6 52	5 26	18 11	19 14	20 15	21 12
20	6 31	5 11	18 33	19 33	20 29	21 22
10	6 12	4 57	18 53	19 49	20 41	21 30
0	5 55	4 39	19 11	20 04	20 52	21 37
10	5 37	4 19	19 29	20 19	21 04	21 45
20	5 18	3 54	19 48	20 35	21 16	21 53
30	4 56	3 19	20 10	20 53	21 30	22 02
35	4 43	2 56	20 23	21 03	21 37	22 07
40	4 28	2 24	20 38	21 15	21 46	22 13
45	4 10	1 37	20 55	21 30	21 57	22 20
50	3 47	////	21 17	21 47	22 10	22 28
52	3 36	////	21 27	21 55	22 15	22 32
54	3 24	////	21 39	22 04	22 22	22 36
56	3 10	////	21 52	22 14	22 29	22 40
58	2 53	////	22 08	22 25	22 37	22 45
60	2 32	////	22 26	22 39	22 46	22 51

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 21 h m	22 h m	23 h m	24 h m
72	▬	17 01	▭	▭	13 03	12 05
70	▬	17 10	▭	▭	12 18	11 45
68	▬	17 18	▭	12 26	11 48	11 29
66	13 22	17 25	12 24	11 41	11 26	11 15
64	14 04	17 30	11 14	11 11	11 08	11 04
62	14 33	17 36	10 38	10 48	10 53	10 55
60	14 55	17 41	10 12	10 30	10 40	10 47
58	15 12	17 45	9 52	10 15	10 30	10 40
56	15 27	17 49	9 34	10 02	10 20	10 33
54	15 40	17 54	9 20	9 50	10 12	10 28
52	15 51	17 57	9 07	9 40	10 04	10 22
50	16 01	18 01	8 56	9 31	9 57	10 18
45	16 22	18 09	8 33	9 12	9 42	10 07
40	16 38	18 16	8 14	8 56	9 30	9 59
35	16 53	18 24	7 58	8 43	9 20	9 52
30	17 05	18 31	7 44	8 31	9 11	9 45
20	17 26	18 45	7 21	8 11	8 55	9 34
10	17 45	19 00	7 01	7 53	8 41	9 24
0	18 02	19 17	6 41	7 37	8 28	9 14
10	18 20	19 38	6 22	7 20	8 14	9 05
20	18 39	20 03	6 02	7 02	8 00	8 55
30	19 01	20 38	5 38	6 41	7 44	8 43
35	19 14	21 01	5 24	6 29	7 34	8 36
40	19 29	21 32	5 07	6 15	7 23	8 28
45	19 47	22 20	4 47	5 59	7 10	8 19
50	20 10	////	4 23	5 38	6 54	8 08
52	20 21	////	4 11	5 28	6 46	8 03
54	20 33	////	3 57	5 17	6 38	7 57
56	20 47	////	3 41	5 04	6 29	7 51
58	21 04	////	3 22	4 49	6 18	7 44
60	21 25	////	2 59	4 31	6 05	7 35

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
21	0 28	11 17	7 57	23 17	8 22
22	1 24	11 19	7 55	23 13	8 18
23	2 16	11 20	7 54	23 08	8 15
24	3 03	11 22	7 52	23 04	8 11

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	21	22	23
°	′	′	′
0	16.4	15.6	14.7
4	16.4	15.6	14.7
8	16.4	15.6	14.7
12	16.4	15.6	14.7
16	16.4	15.6	14.7
20	16.4	15.6	14.7
24	16.4	15.6	14.7
28	16.3	15.6	14.8
32	16.3	15.6	14.8
36	16.3	15.6	14.8
40	16.3	15.6	14.8
44	16.2	15.6	14.9
48	16.2	15.6	14.9
52	16.2	15.6	14.9
56	16.1	15.6	15.0
60	16.1	15.6	15.0
64	16.0	15.6	15.1
68	16.0	15.6	15.1
72	15.9	15.6	15.2
76	15.9	15.6	15.2
80	15.8	15.6	15.3
84	15.8	15.6	15.3
88	15.8	15.6	15.3
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	21	22	23
°	′	′	′
0	15.0	15.6	16.1
4	15.0	15.6	16.1
8	15.1	15.6	16.0
12	15.1	15.6	16.0
16	15.1	15.6	16.0
20	15.1	15.6	16.0
24	15.1	15.6	16.0
28	15.1	15.6	16.0
32	15.2	15.6	15.9
36	15.2	15.6	15.9
40	15.2	15.6	15.9
44	15.3	15.6	15.8
48	15.3	15.6	15.8
52	15.3	15.6	15.8
56	15.4	15.6	15.7
60	15.4	15.6	15.7
64	15.5	15.6	15.6
68	15.5	15.6	15.6
72	15.5	15.6	15.6
76	15.6	15.6	15.5
80	15.6	15.6	15.5
84	15.7	15.6	15.4
88	15.7	15.6	15.4
90			

Subtract from table, back cover

918768°—52——16

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
24 0	92 13.5	189 48.3	−23 07.7	241 51.7	−11 05.9	13 02.8	+22 34.9	236 56.9	−11 35.7	315 34.0	131	+14 38.0	−117
1	107 16.0	204 47.3	08.0	256 52.8	06.4	28 05.6	34.9	251 59.2	35.8	330 06.1	132	14 26.3	−118
2	122 18.4	219 46.4	08.2	271 53.8	06.9	43 08.4	34.8	267 01.4	35.8	344 38.3	133	14 14.5	−119
3	137 20.9	234 45.4	•• 08.5	286 54.8	•• 07.4	58 11.2	•• 34.8	282 03.7	•• 35.9	359 10.6	133	•14 02.6	−119
4	152 23.4	249 44.5	08.8	301 55.8	08.0	73 14.0	34.8	297 05.9	36.0	13 42.9	135	13 50.7	−120
5	167 25.8	264 43.5	09.0	316 56.9	08.5	88 16.9	34.8	312 08.2	36.0	28 15.4	135	13 38.7	−120
6	182 28.3	279 42.6	−23 09.3	331 57.9	−11 09.0	103 19.7	+22 34.8	327 10.4	−11 36.1	42 47.9	136	+13 26.7	−120
7	197 30.8	294 41.6	09.5	346 58.9	09.5	118 22.5	34.7	342 12.7	36.2	57 20.5	137	13 14.7	−121
8	212 33.2	309 40.7	09.8	1 59.9	10.1	133 25.3	34.7	357 14.9	36.2	71 53.2	138	13 02.6	−122
9	227 35.7	324 39.7	•• 10.0	17 01.0	•• 10.6	148 28.1	•• 34.7	12 17.2	•• 36.3	86 26.0	138	•12 50.4	−121
10	242 38.1	339 38.8	10.3	32 02.0	11.1	163 30.9	34.7	27 19.5	36.3	100 58.8	139	12 38.3	−123
11	257 40.6	354 37.9	10.6	47 03.0	11.6	178 33.7	34.7	42 21.7	36.4	115 31.7	140	12 26.0	−122
12	272 43.1	9 36.9	−23 10.8	62 04.0	−11 12.1	193 36.6	+22 34.7	57 24.0	−11 36.5	130 04.7	141	+12 13.8	−123
13	287 45.5	24 36.0	11.1	77 05.1	12.7	208 39.4	34.6	72 26.2	36.5	144 37.8	142	12 01.5	−124
14	302 48.0	39 35.0	11.3	92 06.1	13.2	223 42.2	34.6	87 28.5	36.6	159 11.0	142	11 49.1	−124
15	317 50.5	54 34.1	•• 11.6	107 07.1	•• 13.7	238 45.0	•• 34.6	102 30.7	•• 36.6	173 44.2	143	•11 36.7	−124
16	332 52.9	69 33.1	11.8	122 08.2	14.2	253 47.8	34.6	117 33.0	36.7	188 17.5	144	11 24.3	−124
17	347 55.4	84 32.2	12.1	137 09.2	14.8	268 50.6	34.6	132 35.3	36.8	202 50.9	144	11 11.9	−125
18	2 57.9	99 31.2	−23 12.3	152 10.2	−11 15.3	283 53.4	+22 34.6	147 37.5	−11 36.8	217 24.3	145	+10 59.4	−125
19	18 00.3	114 30.3	12.5	167 11.2	15.8	298 56.3	34.5	162 39.8	36.9	231 57.8	146	10 46.9	−126
20	33 02.8	129 29.3	12.8	182 12.3	16.3	313 59.1	34.5	177 42.0	37.0	246 31.4	147	10 34.3	−126
21	48 05.3	144 28.4	•• 13.0	197 13.3	•• 16.8	329 01.9	•• 34.5	192 44.3	•• 37.0	261 05.1	147	•10 21.7	−126
22	63 07.7	159 27.4	13.3	212 14.3	17.4	344 04.7	34.5	207 46.5	37.1	275 38.8	148	10 09.1	−126
23	78 10.2	174 26.5	13.5	227 15.3	17.9	359 07.5	34.5	222 48.8	37.1	290 12.6	148	9 56.5	−127
25 0	93 12.6	189 25.5	−23 13.7	242 16.4	−11 18.4	14 10.3	+22 34.4	237 51.1	−11 37.2	304 46.4	149	+ 9 43.8	−127
1	108 15.1	204 24.6	14.0	257 17.4	18.9	29 13.1	34.4	252 53.3	37.3	319 20.3	150	9 31.1	−127
2	123 17.6	219 23.6	14.2	272 18.4	19.4	44 16.0	34.4	267 55.6	37.3	333 54.3	150	9 18.4	−128
3	138 20.0	234 22.7	•• 14.4	287 19.4	•• 20.0	59 18.8	•• 34.4	282 57.8	•• 37.4	348 28.3	151	• 9 05.6	−128
4	153 22.5	249 21.7	14.7	302 20.5	20.5	74 21.6	34.4	298 00.1	37.4	3 02.4	152	8 52.8	−128
5	168 25.0	264 20.8	14 9	317 21.5	21.0	89 24.4	34.4	313 02.4	37.5	17 36.6	152	8 40.0	−128
6	183 27.4	279 19.8	−23 15.1	332 22.5	−11 21.5	104 27.2	+22 34.3	328 04.6	−11 37.6	32 10.8	153	+ 8 27.2	−128
7	198 29.9	294 18.9	15.4	347 23.5	22.0	119 30.0	34.3	343 06.9	37.6	46 45.1	153	8 14.4	−129
8	213 32.4	309 17.9	15.6	2 24.6	22.6	134 32.8	34.3	358 09.1	37.7	61 19.4	154	8 01.5	−129
9	228 34.8	324 17.0	•• 15.8	17 25.6	•• 23.1	149 35.7	•• 34.3	13 11.4	•• 37.8	75 53.8	154	• 7 48.6	−129
10	243 37.3	339 16.0	16.0	32 26.6	23.6	164 38.5	34.3	28 13.6	37.8	90 28.2	155	7 35.7	−129
11	258 39.8	354 15.0	16.3	47 27.6	24.1	179 41.3	34.3	43 15.9	37.9	105 02.7	156	7 22.8	−130
12	273 42.2	9 14.1	−23 16.5	62 28.7	−11 24.6	194 44.1	+22 34.2	58 18.2	−11 37.9	119 37.3	156	+ 7 09.8	−129
13	288 44.7	24 13.1	16.7	77 29.7	25.2	209 46.9	34.2	73 20.4	38.0	134 11.9	156	6 56.9	−130
14	303 47.1	39 12.2	16.9	92 30.7	25.7	224 49.7	34.2	88 22.7	38.1	148 46.5	157	6 43.9	−130
15	318 49.6	54 11.2	•• 17.2	107 31.8	•• 26.2	239 52.5	•• 34.2	103 24.9	•• 38.1	163 21.2	157	• 6 30.9	−130
16	333 52.1	69 10.3	17.4	122 32.8	26.7	254 55.3	34.2	118 27.2	38.2	177 55.9	158	6 17.9	−130
17	348 54.5	84 09.3	17.6	137 33.8	27.2	269 58.1	34.1	133 29.5	38.2	192 30.7	158	6 04.9	−130
18	3 57.0	99 08.4	−23 17.8	152 34.8	−11 27.8	285 01.0	+22 34.1	148 31.7	−11 38.3	207 05.5	159	+ 5 51.9	−131
19	18 59.5	114 07.4	18.0	167 35.9	28.3	300 03.8	34.1	163 34.0	38.4	221 40.4	159	5 38.8	−131
20	34 01.9	129 06.5	18.2	182 36.9	28.8	315 06.6	34.1	178 36.2	38.4	236 15.3	160	5 25.7	−130
21	49 04.4	144 05.5	•• 18.4	197 37.9	•• 29.3	330 09.4	•• 34.1	193 38.5	•• 38.5	250 50.3	159	• 5 12.7	−131
22	64 06.9	159 04.6	18.7	212 38.9	29.8	345 12.2	34.1	208 40.8	38.5	265 25.2	161	4 59.6	−131
23	79 09.3	174 03.6	18.9	227 40.0	30.3	0 15.0	34.0	223 43.0	38.6	280 00.3	161	4 46.5	−131
26 0	94 11.8	189 02.6	−23 19.1	242 41.0	−11 30.9	15 17.8	+22 34.0	238 45.3	−11 38.7	294 35.4	161	+ 4 33.4	−131
1	109 14.3	204 01.7	19.3	257 42.0	31.4	30 20.6	34.0	253 47.6	38.7	309 10.5	161	4 20.3	−131
2	124 16.7	219 00.7	19.5	272 43.0	31.9	45 23.4	34.0	268 49.8	38.8	323 45.6	162	4 07.2	−131
3	139 19.2	233 59.8	•• 19.7	287 44.1	•• 32.4	60 26.2	•• 34.0	283 52.1	•• 38.8	338 20.8	162	• 3 54.1	−131
4	154 21.6	248 58.8	19.9	302 45.1	32.9	75 29.1	34.0	298 54.3	38.9	352 56.0	163	3 41.0	−131
5	169 24.1	263 57.9	20.1	317 46.1	33.4	90 31.9	33.9	313 56.6	39.0	7 31.3	162	3 27.9	−132
6	184 26.6	278 56.9	−23 20.3	332 47.1	−11 34.0	105 34.7	+22 33.9	328 58.9	−11 39.0	22 06.5	163	+ 3 14.7	−131
7	199 29.0	293 56.0	20.5	347 48.2	34.5	120 37.5	33.9	344 01.1	39.1	36 41.8	164	3 01.6	−131
8	214 31.5	308 55.0	20.7	2 49.2	35.0	135 40.3	33.9	359 03.4	39.1	51 17.2	163	2 48.5	−132
9	229 34.0	323 54.0	•• 20.9	17 50.2	•• 35.5	150 43.1	•• 33.9	14 05.6	•• 39.2	65 52.5	164	• 2 35.3	−131
10	244 36.4	338 53.1	21.1	32 51.2	36.0	165 45.9	33.8	29 07.9	39.3	80 27.9	164	2 22.2	−132
11	259 38.9	353 52.1	21.3	47 52.3	36.5	180 48.7	33.8	44 10.2	39.3	95 03.3	165	2 09.0	−131
12	274 41.4	8 51.2	−23 21.5	62 53.3	−11 37.1	195 51.5	+22 33.8	59 12.4	−11 39.4	109 38.8	165	+ 1 55.9	−131
13	289 43.8	23 50.2	21.7	77 54.3	37.6	210 54.3	33.8	74 14.7	39.4	124 14.3	165	1 42.8	−132
14	304 46.3	38 49.3	21.8	92 55.3	38.1	225 57.1	33.8	89 17.0	39.5	138 49.8	165	1 29.6	−131
15	319 48.7	53 48.3	•• 22.0	107 56.4	•• 38.6	241 00.0	•• 33.8	104 19.2	•• 39.6	153 25.3	165	• 1 16.5	−131
16	334 51.2	68 47.3	22.2	122 57.4	39.1	256 02.8	33.7	119 21.5	39.6	168 00.8	165	1 03.4	−131
17	349 53.7	83 46.4	22.4	137 58.4	39.6	271 05.6	33.7	134 23.7	39.7	182 36.3	166	0 50.3	−132
18	4 56.1	98 45.4	−23 22.6	152 59.4	−11 40.1	286 08.4	+22 33.7	149 26.0	−11 39.7	197 11.9	166	+ 0 37.1	−131
19	19 58.6	113 44.5	22.8	168 00.5	40.7	301 11.2	33.7	164 28.3	39.8	211 47.5	166	0 24.0	−131
20	35 01.1	128 43.5	23.0	183 01.5	41.2	316 14.0	33.7	179 30.5	39.9	226 23.1	166	+ 0 10.9	−131
21	50 03.5	143 42.5	•• 23.1	198 02.5	•• 41.7	331 16.8	•• 33.7	194 32.8	•• 39.9	240 58.7	167	− 0 02.2	−131
22	65 06.0	158 41.6	23.3	213 03.5	42.2	346 19.6	33.6	209 35.1	40.0	255 34.4	166	0 15.3	−131
23	80 08.5	173 40.6	23.5	228 04.6	42.7	1 22.4	33.6	224 37.3	40.0	270 10.0	167	0 28.4	−131
24	95 10.9	188 39.7	−23 23.7	243 05.6	−11 43.2	16 25.2	+22 33.6	239 39.6	−11 40.1	284 45.7	166	− 0 41.5	−130
code	—	− 10	− 2	+ 10	− 6	+ 28	0	+ 22	− 1				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
24 0	180 10.0	−23 26.0
1	195 09.7	25.9
2	210 09.4	25.9
3	225 09.0 ••	25.9
4	240 08.7	25.8
5	255 08.4	25.8
6	270 08.1	−23 25.7
7	285 07.8	25.7
8	300 07.5	25.6
9	315 07.2 ••	25.6
10	330 06.9	25.6
11	345 06.6	25.5
12	0 06.2	−23 25.5
13	15 05.9	25.4
14	30 05.6	25.4
15	45 05.3 ••	25.3
16	60 05.0	25.3
17	75 04.7	25.2
18	90 04.4	−23 25.2
19	105 04.1	25.1
20	120 03.8	25.1
21	135 03.5 ••	25.0
22	150 03.1	25.0
23	165 02.8	24.9
25 0	180 02.5	−23 24.9
1	195 02.2	24.8
2	210 01.9	24.7
3	225 01.6 ••	24.7
4	240 01.3	24.6
5	255 01.0	24.6
6	270 00.7	−23 24.5
7	285 00.4	24.4
8	300 00.0	24.4
9	314 59.7 ••	24.3
10	329 59.4	24.3
11	344 59.1	24.2
12	359 58.8	−23 24.1
13	14 58.5	24.1
14	29 58.2	24.0
15	44 57.9 ••	23.9
16	59 57.6	23.9
17	74 57.3	23.8
18	89 56.9	−23 23.7
19	104 56.6	23.6
20	119 56.3	23.6
21	134 56.0 ••	23.5
22	149 55.7	23.4
23	164 55.4	23.4
26 0	179 55.1	−23 23.3
1	194 54.8	23.2
2	209 54.5	23.1
3	224 54.2 ••	23.1
4	239 53.8	23.0
5	254 53.5	22.9
6	269 53.2	−23 22.8
7	284 52.9	22.7
8	299 52.6	22.7
9	314 52.3 ••	22.6
10	329 52.0	22.5
11	344 51.7	22.4
12	359 51.4	−23 22.3
13	14 51.1	22.2
14	29 50.8	22.1
15	44 50.4 ••	22.1
16	59 50.1	22.0
17	74 49.8	21.9
18	89 49.5	−23 21.8
19	104 49.2	21.7
20	119 48.9	21.6
21	134 48.6 ••	21.5
22	149 48.3	21.4
23	164 48.0	21.3
24	179 47.7	−23 21.2
code	—	0

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.3
5	Achernar	335 59.5	−57 28.4
30	Acrux	173 59.5	−62 50.5
19	Adhara	255 47.2	−28 54.4
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.7	+56 12.2
34	Alkaid	153 34.0	+49 32.2
55	Al Na'ir	28 39.8	−47 11.2
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.7	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 29.7	+28 50.5
51	Altair	62 52.0	+ 8 44.7
2	Ankaa	353 59.5	−42 33.5
42	Antares	113 21.3	−26 19.9
37	Arcturus	146 36.5	+19 25.1
43	Atria	109 03.8	−68 56.7
22	Avior	234 35.8	−59 21.5
13	Bellatrix	279 19.5	+ 6 18.6
16	Betelg'se	271 49.2	+ 7 24.1
17	Canopus	264 15.4	−52 40.1
12	Capella	281 39.9	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.0	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 45.8	+61 59.6
14	Elnath	279 08.6	+28 34.3
47	Eltanin	91 07.4	+51 29.5
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.2	−29 52.1
31	Gacrux	172 50.9	−56 51.2
29	Gienah	176 38.3	−17 17.2
35	Hadar	149 51.7	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.4	+74 20.2
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.7
36	Menkent	149 00.5	−36 08.6
24	Miapl'dus	221 48.8	−69 31.5
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.2
21	Pollux	244 21.8	+28 08.3
20	Procyon	245 46.0	+ 5 20.6
46	R'alhague	96 48.2	+12 35.4
26	Regulus	208 30.7	+12 11.4
11	Rigel	281 54.6	− 8 15.1
38	Rigil Kent.	140 53.3	−60 38.7
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.5	+56 17.5
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 12.7	−16 39.0
33	Spica	159 18.4	−10 55.4
23	Suhail	223 25.0	−43 14.6
49	Vega	81 09.6	+38 44.4
39	Zub'g'bi	137 55.1	−15 51.2

Lat.	Sunrise	Twlt. begins	Moonrise 24	25	26	27
N °	h m	h m	h m	h m	h m	h m
72	▬	6 55	19 11	21 14	23 07	24 59
70	▬	6 46	19 30	21 21	23 06	24 50
68	▬	6 39	19 44	21 27	23 05	24 43
66	10 36	6 33	19 56	21 32	23 05	24 36
64	9 53	6 27	20 05	21 37	23 04	24 31
62	9 25	6 22	20 14	21 40	23 04	24 27
60	9 04	6 17	20 21	21 43	23 04	24 23
58	8 46	6 13	20 27	21 46	23 03	24 19
56	8 31	6 09	20 32	21 49	23 03	24 16
54	8 19	6 04	20 37	21 51	23 03	24 14
52	8 07	6 01	20 41	21 53	23 02	24 11
50	7 58	5 57	20 45	21 55	23 02	24 09
45	7 37	5 50	20 54	21 59	23 02	24 04
40	7 20	5 42	21 01	22 02	23 01	24 00
35	7 06	5 35	21 07	22 05	23 01	23 57
30	6 54	5 27	21 12	22 08	23 01	23 54
20	6 32	5 13	21 22	22 12	23 00	23 48
10	6 14	4 58	21 30	22 16	23 00	23 44
0	5 56	4 41	21 37	22 19	23 00	23 40
10	5 39	4 20	21 45	22 23	22 59	23 36
20	5 20	3 55	21 53	22 27	22 59	23 31
30	4 58	3 20	22 02	22 31	22 59	23 26
35	4 45	2 57	22 07	22 33	22 58	23 23
40	4 30	2 26	22 13	22 36	22 58	23 20
45	4 12	1 38	22 20	22 39	22 58	23 16
50	3 49	////	22 28	22 43	22 58	23 12
52	3 38	////	22 32	22 45	22 58	23 10
54	3 26	////	22 36	22 47	22 57	23 08
56	3 12	////	22 40	22 49	22 57	23 05
58	2 55	////	22 45	22 51	22 57	23 03
60	2 34	////	22 51	22 54	22 57	23 00
S						

Lat.	Sunset	Twlt. ends	Moonset 24	25	26	27
N °	h m	h m	h m	h m	h m	h m
72	▬	17 04	12 05	11 32	11 05	10 40
70	▬	17 13	11 45	11 22	11 02	10 44
68	▬	17 20	11 29	11 13	11 00	10 47
66	13 25	17 27	11 15	11 06	10 58	10 50
64	14 07	17 33	11 04	11 00	10 57	10 53
62	14 35	17 38	10 55	10 55	10 55	10 55
60	14 57	17 43	10 47	10 51	10 54	10 57
58	15 14	17 47	10 40	10 47	10 53	10 58
56	15 29	17 51	10 33	10 43	10 52	11 00
54	15 42	17 56	10 28	10 40	10 51	11 01
52	15 53	17 59	10 22	10 37	10 50	11 02
50	16 03	18 03	10 18	10 34	10 49	11 04
45	16 23	18 10	10 07	10 29	10 48	11 06
40	16 40	18 18	9 59	10 24	10 46	11 08
35	16 54	18 25	9 52	10 19	10 45	11 10
30	17 07	18 33	9 45	10 16	10 44	11 11
20	17 28	18 47	9 34	10 09	10 42	11 14
10	17 46	19 01	9 24	10 03	10 40	11 17
0	18 04	19 19	9 14	9 58	10 39	11 19
10	18 21	19 39	9 05	9 52	10 37	11 21
20	18 40	20 04	8 55	9 46	10 35	11 24
30	19 02	20 39	8 43	9 39	10 33	11 26
35	19 15	21 02	8 36	9 35	10 32	11 28
40	19 30	21 33	8 28	9 31	10 31	11 30
45	19 48	22 21	8 19	9 25	10 29	11 32
50	20 11	////	8 08	9 19	10 27	11 34
52	20 22	////	8 03	9 16	10 27	11 36
54	20 34	////	7 57	9 13	10 26	11 37
56	20 48	////	7 51	9 09	10 25	11 38
58	21 05	////	7 44	9 05	10 23	11 40
60	21 26	////	7 35	9 01	10 22	11 42
S						

GMT	Equation of Time (App.—Mean) 24	25	26
h	m s	m s	m s
0	+ 0 40.5	+ 0 10.7	− 0 19.0
6	+ 0 33.1	+ 0 03.3	− 0 26.5
12	+ 0 25.6	− 0 04.2	− 0 33.9
18	+ 0 18.2	− 0 11.6	− 0 41.3
24	+ 0 10.7	− 0 19.0	− 0 48.7

GMT of Transit Meridian of Greenwich

DAY	Moon	Venus	Mars	Jupiter	Saturn
	h m	h m	h m	h m	h m
24	3 03	11 22	7 52	23 04	8 11
25	3 48	11 23	7 50	22 59	8 07
26	4 29	11 25	7 49	22 55	8 04
27	5 09	11 26	7 47	22 50	8 00

ADDITIONAL ALTITUDE CORRECTIONS

Alt.	Sun's Low'r Limb Add	Venus Add	Mars Add
°	′	′	′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt.	24	25	26
°	′	′	′
0	13.8	13.1	12.5
4	13.8	13.1	12.5
8	13.8	13.2	12.5
12	13.8	13.2	12.6
16	13.8	13.2	12.6
20	13.9	13.3	12.7
24	13.9	13.3	12.7
28	14.0	13.4	12.8
32	14.0	13.5	12.9
36	14.1	13.5	13.0
40	14.1	13.6	13.1
44	14.2	13.7	13.2
48	14.3	13.8	13.4
52	14.3	13.9	13.5
56	14.4	14.0	13.6
60	14.5	14.1	13.8
64	14.6	14.3	13.9
68	14.7	14.4	14.1
72	14.8	14.5	14.2
76	14.9	14.6	14.4
80	15.0	14.8	14.6
84	15.1	14.9	14.7
88	15.1	15.0	14.9
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt.	24	25	26
°	′	′	′
0	16.6	16.9	17.3
4	16.6	16.9	17.3
8	16.5	16.9	17.3
12	16.5	16.9	17.2
16	16.5	16.8	17.2
20	16.5	16.8	17.1
24	16.4	16.7	17.1
28	16.4	16.7	17.0
32	16.3	16.6	16.9
36	16.3	16.5	16.8
40	16.2	16.4	16.7
44	16.1	16.4	16.6
48	16.1	16.3	16.4
52	16.0	16.2	16.3
56	15.9	16.0	16.2
60	15.8	15.9	16.0
64	15.7	15.8	15.9
68	15.6	15.7	15.7
72	15.6	15.6	15.6
76	15.5	15.4	15.4
80	15.4	15.3	15.2
84	15.3	15.2	15.1
88	15.2	15.1	14.9
90			

Subtract from table, back cover

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
27 0	95 10.9	188 39.7	−23 23.7	243 05.6	−11 43.2	16 25.2	+22 33.6	239 39.6	−11 40.1	284 45.7	166	− 0 41.5	−130
1	110 13.4	203 38.7	23.9	258 06.6	43.7	31 28.0	33.6	254 41.8	40.2	299 21.3	167	0 54.5	−131
2	125 15.9	218 37.8	24.0	273 07.6	44.3	46 30.8	33.6	269 44.1	40.2	313 57.0	167	1 07.6	−131
3	140 18.3	233 36.8	•• 24.2	288 08.7	•• 44.8	61 33.6	•• 33.5	284 46.4	•• 40.3	328 32.7	167	• 1 20.7	−130
4	155 20.8	248 35.8	24.4	303 09.7	45.3	76 36.4	33.5	299 48.6	40.3	343 08.4	167	1 33.7	−130
5	170 23.2	263 34.9	24.6	318 10.7	45.8	91 39.2	33.5	314 50.9	40.4	357 44.1	167	1 46.7	−131
6	185 25.7	278 33.9	−23 24.7	333 11.7	−11 46.3	106 42.1	+22 33.5	329 53.2	−11 40.5	12 19.8	167	− 1 59.8	−130
7	200 28.2	293 33.0	24.9	348 12.7	46.8	121 44.9	33.5	344 55.4	40.5	26 55.5	167	2 12.8	−130
8	215 30.6	308 32.0	25.1	3 13.8	47.3	136 47.7	33.5	359 57.7	40.6	41 31.2	167	2 25.8	−129
9	230 33.1	323 31.0	•• 25.2	18 14.8	•• 47.9	151 50.5	•• 33.4	15 00.0	•• 40.6	56 06.9	167	• 2 38.7	−130
10	245 35.6	338 30.1	25.4	33 15.8	48.4	166 53.3	33.4	30 02.2	40.7	70 42.6	167	2 51.7	−130
11	260 38.0	353 29.1	25.6	48 16.8	48.9	181 56.1	33.4	45 04.5	40.7	85 18.3	167	3 04.7	−129
12	275 40.5	8 28.1	−23 25.7	63 17.9	−11 49.4	196 58.9	+22 33.4	60 06.8	−11 40.8	99 54.0	167	− 3 17.6	−129
13	290 43.0	23 27.2	25.9	78 18.9	49.9	212 01.7	33.4	75 09.0	40.9	114 29.7	167	3 30.5	−129
14	305 45.4	38 26.2	26.0	93 19.9	50.4	227 04.5	33.4	90 11.3	40.9	129 05.4	167	3 43.4	−129
15	320 47.9	53 25.3	•• 26.2	108 20.9	•• 50.9	242 07.3	•• 33.3	105 13.5	•• 41.0	143 41.1	167	• 3 56.3	−129
16	335 50.3	68 24.3	26.4	123 22.0	51.4	257 10.1	33.3	120 15.8	41.0	158 16.8	167	4 09.2	−128
17	350 52.8	83 23.3	26.5	138 23.0	51.9	272 12.9	33.3	135 18.1	41.1	172 52.5	167	4 22.0	−129
18	5 55.3	98 22.4	−23 26.7	153 24.0	−11 52.5	287 15.7	+22 33.3	150 20.3	−11 41.2	187 28.2	166	− 4 34.9	−128
19	20 57.7	113 21.4	26.8	168 25.0	53.0	302 18.5	33.3	165 22.6	41.2	202 03.8	167	4 47.7	−128
20	36 00.2	128 20.5	27.0	183 26.1	53.5	317 21.3	33.3	180 24.9	41.3	216 39.5	166	5 00.5	−127
21	51 02.7	143 19.5	•• 27.1	198 27.1	•• 54.0	332 24.1	•• 33.2	195 27.1	•• 41.3	231 15.1	167	• 5 13.2	−128
22	66 05.1	158 18.5	27.3	213 28.1	54.5	347 26.9	33.2	210 29.4	41.4	245 50.8	166	5 26.0	−127
23	81 07.6	173 17.6	27.4	228 29.1	55.0	2 29.7	33.2	225 31.7	41.4	260 26.4	166	5 38.7	−127
28 0	96 10.1	188 16.6	−23 27.6	243 30.2	−11 55.5	17 32.5	+22 33.2	240 33.9	−11 41.5	275 02.0	166	− 5 51.4	−127
1	111 12.5	203 15.6	27.7	258 31.2	56.0	32 35.3	33.2	255 36.2	41.6	289 37.6	166	6 04.1	−126
2	126 15.0	218 14.7	27.9	273 32.2	56.5	47 38.1	33.1	270 38.5	41.6	304 13.2	165	6 16.7	−126
3	141 17.5	233 13.7	•• 28.0	288 33.2	•• 57.1	62 40.9	•• 33.1	285 40.7	•• 41.7	318 48.7	166	• 6 29.3	−126
4	156 19.9	248 12.7	28.2	303 34.2	57.6	77 43.7	33.1	300 43.0	41.7	333 24.3	165	6 41.9	−126
5	171 22.4	263 11.8	28.3	318 35.3	58.1	92 46.5	33.1	315 45.3	41.8	347 59.8	165	6 54.5	−126
6	186 24.8	278 10.8	−23 28.4	333 36.3	−11 58.6	107 49.3	+22 33.1	330 47.5	−11 41.8	2 35.3	164	− 7 07.1	−125
7	201 27.3	293 09.9	28.6	348 37.3	59.1	122 52.1	33.1	345 49.8	41.9	17 10.7	165	7 19.6	−125
8	216 29.8	308 08.9	28.7	3 38.3	11 59.6	137 54.9	33.0	0 52.1	42.0	31 46.2	164	7 32.1	−125
9	231 32.2	323 07.9	•• 28.9	18 39.4	•12 00.1	152 57.7	•• 33.0	15 54.3	•• 42.0	46 21.6	164	• 7 44.6	−124
10	246 34.7	338 07.0	29.0	33 40.4	00.6	168 00.5	33.0	30 56.6	42.1	60 57.0	164	7 57.0	−124
11	261 37.2	353 06.0	29.1	48 41.4	01.1	183 03.3	33.0	45 58.9	42.1	75 32.4	164	8 09.4	−124
12	276 39.6	8 05.0	−23 29.3	63 42.4	−12 01.6	198 06.1	+22 33.0	61 01.2	−11 42.2	90 07.8	163	− 8 21.8	−123
13	291 42.1	23 04.1	29.4	78 43.5	02.1	213 08.9	33.0	76 03.4	42.2	104 43.1	163	8 34.1	−123
14	306 44.6	38 03.1	29.5	93 44.5	02.7	228 11.8	32.9	91 05.7	42.3	119 18.4	162	8 46.4	−123
15	321 47.0	53 02.1	•• 29.6	108 45.5	•• 03.2	243 14.6	•• 32.9	106 08.0	•• 42.4	133 53.6	163	• 8 58.7	−123
16	336 49.5	68 01.2	29.8	123 46.5	03.7	258 17.4	32.9	121 10.2	42.4	148 28.9	162	9 11.0	−122
17	351 52.0	83 00.2	29.9	138 47.6	04.2	273 20.2	32.9	136 12.5	42.5	163 04.1	161	9 23.2	−122
18	6 54.4	97 59.3	−23 30.0	153 48.6	−12 04.7	288 22.9	+22 32.9	151 14.8	−11 42.5	177 39.2	162	− 9 35.4	−121
19	21 56.9	112 58.3	30.1	168 49.6	05.2	303 25.7	32.8	166 17.0	42.6	192 14.4	161	9 47.5	−121
20	36 59.3	127 57.3	30.3	183 50.6	05.7	318 28.5	32.8	181 19.3	42.6	206 49.5	160	9 59.6	−121
21	52 01.8	142 56.4	•• 30.4	198 51.6	•• 06.2	333 31.3	•• 32.8	196 21.6	•• 42.7	221 24.5	161	•10 11.7	−120
22	67 04.3	157 55.4	30.5	213 52.7	06.7	348 34.1	32.8	211 23.8	42.8	235 59.6	159	10 23.7	−120
23	82 06.7	172 54.4	30.6	228 53.7	07.2	3 36.9	32.8	226 26.1	42.8	250 34.5	160	10 35.7	−120
29 0	97 09.2	187 53.5	−23 30.8	243 54.7	−12 07.7	18 39.7	+22 32.8	241 28.4	−11 42.9	265 09.5	159	−10 47.7	−119
1	112 11.7	202 52.5	30.9	258 55.7	08.2	33 42.5	32.7	256 30.6	42.9	279 44.4	159	10 59.6	−119
2	127 14.1	217 51.5	31.0	273 56.8	08.7	48 45.3	32.7	271 32.9	43.0	294 19.3	158	11 11.5	−118
3	142 16.6	232 50.6	•• 31.1	288 57.8	•• 09.2	63 48.1	•• 32.7	286 35.2	•• 43.0	308 54.1	158	•11 23.3	−118
4	157 19.1	247 49.6	31.2	303 58.8	09.7	78 50.9	32.7	301 37.5	43.1	323 28.9	157	11 35.1	−118
5	172 21.5	262 48.6	31.3	318 59.8	10.3	93 53.7	32.7	316 39.7	43.2	338 03.6	157	11 46.9	−117
6	187 24.0	277 47.7	−23 31.4	334 00.8	−12 10.8	108 56.5	+22 32.7	331 42.0	−11 43.2	352 38.3	157	−11 58.6	−117
7	202 26.5	292 46.7	31.5	349 01.9	11.3	123 59.3	32.6	346 44.3	43.3	7 13.0	156	12 10.3	−116
8	217 28.9	307 45.7	31.6	4 02.9	11.8	139 02.1	32.6	1 46.5	43.3	21 47.6	155	12 21.9	−116
9	232 31.4	322 44.8	•• 31.8	19 03.9	•• 12.3	154 04.9	•• 32.6	16 48.8	•• 43.4	36 22.1	155	•12 33.5	−115
10	247 33.8	337 43.8	31.9	34 04.9	12.8	169 07.7	32.6	31 51.1	43.4	50 56.6	155	12 45.0	−115
11	262 36.3	352 42.8	32.0	49 06.0	13.3	184 10.5	32.6	46 53.4	43.5	65 31.1	154	12 56.5	−114
12	277 38.8	7 41.9	−23 32.1	64 07.0	−12 13.8	199 13.3	+22 32.6	61 55.6	−11 43.6	80 05.5	153	−13 07.9	−114
13	292 41.2	22 40.9	32.2	79 08.0	14.3	214 16.1	32.5	76 57.9	43.6	94 39.8	153	13 19.3	−114
14	307 43.7	37 39.9	32.3	94 09.0	14.8	229 18.9	32.5	92 00.2	43.7	109 14.1	153	13 30.7	−113
15	322 46.2	52 39.0	•• 32.4	109 10.1	•• 15.3	244 21.7	•• 32.5	107 02.4	•• 43.7	123 48.4	152	•13 42.0	−112
16	337 48.6	67 38.0	32.5	124 11.1	15.8	259 24.5	32.5	122 04.7	43.8	138 22.6	151	13 53.2	−112
17	352 51.1	82 37.0	32.6	139 12.1	16.3	274 27.3	32.5	137 07.0	43.8	152 56.7	151	14 04.4	−112
18	7 53.6	97 36.1	−23 32.7	154 13.1	−12 16.8	289 30.1	+22 32.4	152 09.2	−11 43.9	167 30.8	150	−14 15.6	−111
19	22 56.0	112 35.1	32.7	169 14.1	17.3	304 32.9	32.4	167 11.5	43.9	182 04.8	150	14 26.7	−110
20	37 58.5	127 34.1	32.8	184 15.2	17.8	319 35.7	32.4	182 13.8	44.0	196 38.8	149	14 37.7	−110
21	53 00.9	142 33.2	•• 32.9	199 16.2	•• 18.3	334 38.5	•• 32.4	197 16.1	•• 44.1	211 12.7	149	•14 48.7	−109
22	68 03.4	157 32.2	33.0	214 17.2	18.8	349 41.3	32.4	212 18.3	44.1	225 46.6	148	14 59.6	−109
23	83 05.9	172 31.2	33.1	229 18.2	19.3	4 44.1	32.4	227 20.6	44.2	240 20.4	147	15 10.5	−108
24	98 08.3	187 30.3	−23 33.2	244 19.3	−12 19.8	19 46.9	+22 32.3	242 22.9	−11 44.2	254 54.1	147	−15 21.3	−108
code	—	− 9	− 1	+ 11	− 5	+ 28	0	+ 22	0				

GMT	SUN GHA	SUN Dec.
h	° ′	° ′
27 0	179 47.7	−23 21.2
1	194 47.4	21.1
2	209 47.0	21.0
3	224 46.7	20.9
4	239 46.4	20.8
5	254 46.1	20.7
6	269 45.8	−23 20.6
7	284 45.5	20.5
8	299 45.2	20.4
9	314 44.9	20.3
10	329 44.6	20.2
11	344 44.3	20.1
12	359 44.0	−23 20.0
13	14 43.7	19.9
14	29 43.4	19.8
15	44 43.0	19.7
16	59 42.7	19.6
17	74 42.4	19.5
18	89 42.1	−23 19.4
19	104 41.8	19.3
20	119 41.5	19.2
21	134 41.2	19.1
22	149 40.9	18.9
23	164 40.6	18.8
28 0	179 40.3	−23 18.7
1	194 40.0	18.6
2	209 39.7	18.5
3	224 39.4	18.4
4	239 39.0	18.3
5	254 38.7	18.1
6	269 38.4	−23 18.0
7	284 38.1	17.9
8	299 37.8	17.8
9	314 37.5	17.6
10	329 37.2	17.5
11	344 36.9	17.4
12	359 36.6	−23 17.3
13	14 36.3	17.2
14	29 36.0	17.0
15	44 35.7	16.9
16	59 35.4	16.8
17	74 35.1	16.6
18	89 34.8	−23 16.5
19	104 34.5	16.4
20	119 34.1	16.3
21	134 33.8	16.1
22	149 33.5	16.0
23	164 33.2	15.9
29 0	179 32.9	−23 15.7
1	194 32.6	15.6
2	209 32.3	15.5
3	224 32.0	15.3
4	239 31.7	15.2
5	254 31.4	15.0
6	269 31.1	−23 14.9
7	284 30.8	14.8
8	299 30.5	14.6
9	314 30.2	14.5
10	329 29.9	14.3
11	344 29.6	14.2
12	359 29.3	−23 14.1
13	14 29.0	13.9
14	29 28.7	13.8
15	44 28.3	13.6
16	59 28.0	13.5
17	74 27.7	13.3
18	89 27.4	−23 13.2
19	104 27.1	13.0
20	119 26.8	12.9
21	134 26.5	12.7
22	149 26.2	12.6
23	164 25.9	12.4
24	179 25.6	−23 12.3
code	−	+ 1

STARS No.	Name	SHA	Dec.
		° ′	° ′
7	Acamar	315 51.8	−40 29.4
5	Achernar	335 59.5	−57 28.4
30	Acrux	173 59.4	−62 50.5
19	Adhara	255 47.2	−28 54.5
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.6	+56 12.2
34	Alkaid	153 34.0	+49 32.2
55	Al Na'ir	28 39.8	−47 11.2
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.6	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 29.8	+28 50.5
51	Altair	62 52.0	+ 8 44.7
2	Ankaa	353 59.5	−42 33.5
42	Antares	113 21.3	−26 19.9
37	Arcturus	146 36.5	+19 25.0
43	Atria	109 03.8	−68 56.7
22	Avior	234 35.8	−59 21.5
13	Bellatrix	279 19.5	+ 6 18.6
16	Betelg'se	271 49.2	+ 7 24.1
17	Canopus	264 15.4	−52 40.1
12	Capella	281 39.9	+45 57.3
53	Deneb	50 02.3	+45 07.1
28	Denebola	183 19.0	+14 49.6
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 45.8	+61 59.6
14	Elnath	279 08.6	+28 34.3
47	Eltanin	91 07.4	+51 29.5
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.2	−29 52.1
31	Gacrux	172 50.8	−56 51.2
29	Gienah	176 38.2	−17 17.2
35	Hadar	149 51.7	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.4	+74 20.2
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.7
36	Menkent	149 00.4	−36 08.6
24	Miapl'dus	221 48.8	−69 31.5
9	Mirfak	309 43.9	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.2
21	Pollux	244 21.8	+28 08.3
20	Procyon	245 46.0	+ 5 20.6
46	R'alhague	96 48.2	+12 35.4
26	Regulus	208 30.7	+12 11.4
11	Rigel	281 54.6	− 8 15.2
38	Rigil Kent.	140 53.3	−60 38.7
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.5	+56 17.5
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 12.6	−16 39.1
33	Spica	159 18.4	−10 55.4
23	Suhail	223 25.0	−43 14.6
49	Vega	81 09.6	+38 44.3
39	Zub'g'bi	137 55.0	−15 51.2

GMT	Equation of Time (App.—Mean) 27	28	29
h	m s	m s	m s
0	− 0 48.7	− 1 18.3	− 1 47.7
6	− 0 56.1	− 1 25.6	− 1 55.0
12	− 1 03.5	− 1 33.0	− 2 02.4
18	− 1 10.9	− 1 40.4	− 2 09.7
24	− 1 18.3	− 1 47.7	− 2 16.9

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 27 h m	28 h m	29 h m	30 h m
72	▬	6 55	24 59	0 59	2 59	5 31
70	▬	6 47	24 50	0 50	2 39	4 42
68	▬	6 40	24 43	0 43	2 23	4 12
66	10 34	6 34	24 36	0 36	2 10	3 49
64	9 53	6 28	24 31	0 31	1 59	3 32
62	9 25	6 23	24 27	0 27	1 50	3 17
60	9 04	6 18	24 23	0 23	1 43	3 05
58	8 46	6 13	24 19	0 19	1 36	2 55
56	8 32	6 10	24 16	0 16	1 30	2 46
54	8 19	6 06	24 14	0 14	1 25	2 38
52	8 08	6 02	24 11	0 11	1 20	2 31
50	7 58	5 59	24 09	0 09	1 16	2 24
45	7 38	5 51	24 04	0 04	1 07	2 10
40	7 21	5 43	24 00	0 00	0 59	1 59
35	7 07	5 36	23 57	24 53	0 53	1 49
30	6 55	5 29	23 54	24 47	0 47	1 41
20	6 34	5 14	23 48	24 37	0 37	1 27
10	6 15	5 00	23 44	24 28	0 28	1 14
0	5 58	4 42	23 40	24 20	0 20	1 03
10	5 41	4 22	23 36	24 12	0 12	0 51
20	5 22	3 57	23 31	24 04	0 04	0 39
30	5 00	3 23	23 26	23 54	24 25	0 25
35	4 47	2 59	23 23	23 49	24 17	0 17
40	4 32	2 28	23 20	23 43	24 08	0 08
45	4 14	1 41	23 16	23 36	23 57	24 22
50	3 51	////	23 12	23 27	23 44	24 05
52	3 41	////	23 10	23 23	23 39	23 58
54	3 28	////	23 08	23 19	23 32	23 49
56	3 14	////	23 05	23 14	23 25	23 39
58	2 58	////	23 03	23 09	23 17	23 27
60 S	2 37	////	23 00	23 03	23 08	23 15

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 27 h m	28 h m	29 h m	30 h m
72	▬	17 07	10 40	10 13	9 38	8 36
70	▬	17 15	10 44	10 24	10 01	9 26
68	▬	17 23	10 47	10 34	10 18	9 58
66	13 30	17 30	10 50	10 42	10 33	10 22
64	14 11	17 36	10 53	10 49	10 45	10 40
62	14 38	17 40	10 55	10 54	10 55	10 56
60	15 00	17 45	10 57	11 00	11 03	11 09
58	15 17	17 49	10 58	11 04	11 11	11 20
56	15 31	17 53	11 00	11 08	11 18	11 30
54	15 44	17 57	11 01	11 12	11 24	11 38
52	15 55	18 01	11 02	11 15	11 29	11 46
50	16 05	18 04	11 04	11 18	11 34	11 53
45	16 25	18 12	11 06	11 25	11 45	12 08
40	16 42	18 20	11 08	11 30	11 54	12 21
35	16 56	18 27	11 10	11 35	12 02	12 31
30	17 09	18 34	11 11	11 39	12 08	12 40
20	17 30	18 49	11 14	11 47	12 20	12 57
10	17 48	19 03	11 17	11 53	12 31	13 11
0	18 05	19 20	11 19	11 59	12 40	13 24
10	18 23	19 41	11 21	12 05	12 50	13 37
20	18 42	20 06	11 24	12 12	13 01	13 51
30	19 04	20 40	11 26	12 19	13 13	14 08
35	19 17	21 04	11 28	12 24	13 20	14 17
40	19 31	21 34	11 30	12 29	13 28	14 28
45	19 49	22 21	11 32	12 34	13 37	14 41
50	20 12	////	11 34	12 41	13 49	14 57
52	20 22	////	11 36	12 44	13 54	15 05
54	20 35	////	11 37	12 48	14 00	15 13
56	20 49	////	11 38	12 52	14 06	15 22
58	21 05	////	11 40	12 56	14 13	15 33
60 S	21 25	////	11 42	13 01	14 22	15 45

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
27	5 09	11 26	7 47	22 50	8 00
28	5 49	11 28	7 46	22 46	7 57
29	6 30	11 29	7 44	22 41	7 53
30	7 13	11 31	7 42	22 37	7 49

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	27 ′	28 ′	29 ′
0	12.1	12.0	12.1
4	12.1	12.0	12.1
8	12.2	12.0	12.2
12	12.2	12.1	12.2
16	12.2	12.1	12.2
20	12.3	12.2	12.3
24	12.4	12.3	12.4
28	12.5	12.4	12.5
32	12.6	12.5	12.6
36	12.7	12.6	12.7
40	12.8	12.7	12.8
44	12.9	12.8	12.9
48	13.1	13.0	13.1
52	13.2	13.1	13.2
56	13.4	13.3	13.4
60	13.5	13.5	13.5
64	13.7	13.6	13.7
68	13.9	13.8	13.9
72	14.1	14.0	14.1
76	14.3	14.2	14.3
80	14.4	14.4	14.4
84	14.6	14.6	14.6
88	14.8	14.7	14.8
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	27 ′	28 ′	29 ′
0	17.5	17.6	17.5
4	17.5	17.6	17.5
8	17.5	17.5	17.5
12	17.4	17.5	17.4
16	17.4	17.5	17.4
20	17.3	17.4	17.3
24	17.2	17.3	17.2
28	17.2	17.2	17.2
32	17.1	17.1	17.1
36	16.9	17.0	16.9
40	16.8	16.9	16.8
44	16.7	16.7	16.7
48	16.6	16.6	16.6
52	16.4	16.4	16.4
56	16.2	16.3	16.2
60	16.1	16.1	16.1
64	15.9	15.9	15.9
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.2	15.2
84	15.0	15.0	15.0
88	14.9	14.8	14.9
90			

Subtract from table, back cover

Last Quarter 28

GMT	♈ GHA	VENUS −3.4 GHA	Dec.	MARS 1.6 GHA	Dec.	JUPITER −2.3 GHA	Dec.	SATURN 0.8 GHA	Dec.	MOON GHA	code	Dec.	code
h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	
30 0	98 08.3	187 30.3	−23 33.2	244 19.3	−12 19.8	19 46.9	+22 32.3	242 22.9	−11 44.2	254 54.1	147	−15 21.3	−108
1	113 10.8	202 29.3	33.3	259 20.3	20.3	34 49.7	32.3	257 25.2	44.3	269 27.8	146	15 32.1	−107
2	128 13.3	217 28.3	33.4	274 21.3	20.8	49 52.4	32.3	272 27.4	44.3	284 01.4	145	15 42.8	−107
3	143 15.7	232 27.3	•• 33.4	289 22.3	•• 21.4	64 55.2	•• 32.3	287 29.7	•• 44.4	298 34.9	145	•15 53.5	−106
4	158 18.2	247 26.4	33.5	304 23.3	21.9	79 58.0	32.3	302 32.0	44.4	313 08.4	144	16 04.1	−105
5	173 20.7	262 25.4	33.6	319 24.4	22.4	95 00.8	32.3	317 34.2	44.5	327 41.8	143	16 14.6	−105
6	188 23.1	277 24.4	−23 33.7	334 25.4	−12 22.9	110 03.6	+22 32.2	332 36.5	−11 44.6	342 15.1	143	−16 25.1	−104
7	203 25.6	292 23.5	33.8	349 26.4	23.4	125 06.4	32.2	347 38.8	44.6	356 48.4	142	16 35.5	−103
8	218 28.1	307 22.5	33.8	4 27.4	23.9	140 09.2	32.2	2 41.1	44.7	11 21.6	142	16 45.8	−103
9	233 30.5	322 21.5	•• 33.9	19 28.4	•• 24.4	155 12.0	•• 32.2	17 43.3	•• 44.7	25 54.8	141	•16 56.1	−102
10	248 33.0	337 20.6	34.0	34 29.5	24.9	170 14.8	32.2	32 45.6	44.8	40 27.9	140	17 06.3	−101
11	263 35.4	352 19.6	34.1	49 30.5	25.4	185 17.6	32.2	47 47.9	44.8	55 00.9	139	17 16.4	−101
12	278 37.9	7 18.6	−23 34.1	64 31.5	−12 25.9	200 20.4	+22 32.1	62 50.2	−11 44.9	69 33.8	139	−17 26.5	−100
13	293 40.4	22 17.7	34.2	79 32.5	26.4	215 23.2	32.1	77 52.4	44.9	84 06.7	138	17 36.5	−100
14	308 42.8	37 16.7	34.3	94 33.6	26.9	230 26.0	32.1	92 54.7	45.0	98 39.5	137	17 46.5	− 99
15	323 45.3	52 15.7	•• 34.4	109 34.6	•• 27.4	245 28.8	•• 32.1	107 57.0	•• 45.1	113 12.2	137	•17 56.4	− 98
16	338 47.8	67 14.8	34.4	124 35.6	27.9	260 31.5	32.1	122 59.3	45.1	127 44.9	135	18 06.2	− 97
17	353 50.2	82 13.8	34.5	139 36.6	28.4	275 34.3	32.1	138 01.5	45.2	142 17.4	135	18 15.9	− 97
18	8 52.7	97 12.8	−23 34.6	154 37.6	−12 28.9	290 37.1	+22 32.0	153 03.8	−11 45.2	156 49.9	135	−18 25.6	− 96
19	23 55.2	112 11.8	34.6	169 38.7	29.4	305 39.9	32.0	168 06.1	45.3	171 22.4	133	18 35.2	− 95
20	38 57.6	127 10.9	34.7	184 39.7	29.9	320 42.7	32.0	183 08.4	45.3	185 54.7	133	18 44.7	− 95
21	54 00.1	142 09.9	•• 34.7	199 40.7	•• 30.4	335 45.5	•• 32.0	198 10.6	•• 45.4	200 27.0	132	•18 54.2	− 93
22	69 02.6	157 08.9	34.8	214 41.7	30.9	350 48.3	32.0	213 12.9	45.4	214 59.2	131	19 03.5	− 93
23	84 05.0	172 08.0	34.9	229 42.8	31.4	5 51.1	31.9	228 15.2	45.5	229 31.3	131	19 12.8	− 92
31 0	99 07.5	187 07.0	−23 34.9	244 43.8	−12 31.9	20 53.9	+22 31.9	243 17.5	−11 45.5	244 03.4	130	−19 22.0	− 92
1	114 09.9	202 06.0	35.0	259 44.8	32.4	35 56.7	31.9	258 19.7	45.6	258 35.4	129	19 31.2	− 90
2	129 12.4	217 05.1	35.0	274 45.8	32.9	50 59.4	31.9	273 22.0	45.7	273 07.3	128	19 40.2	− 90
3	144 14.9	232 04.1	•• 35.1	289 46.8	•• 33.4	66 02.2	•• 31.9	288 24.3	•• 45.7	287 39.1	127	•19 49.2	− 89
4	159 17.3	247 03.1	35.1	304 47.9	33.9	81 05.0	31.9	303 26.6	45.8	302 10.8	127	19 58.1	− 88
5	174 19.8	262 02.2	35.2	319 48.9	34.4	96 07.8	31.8	318 28.8	45.8	316 42.5	125	20 06.9	− 88
6	189 22.3	277 01.2	−23 35.2	334 49.9	−12 34.9	111 10.6	+22 31.8	333 31.1	−11 45.9	331 14.0	125	−20 15.7	− 86
7	204 24.7	292 00.2	35.3	349 50.9	35.4	126 13.4	31.8	348 33.4	45.9	345 45.5	124	20 24.3	− 86
8	219 27.2	306 59.2	35.3	4 51.9	35.9	141 16.2	31.8	3 35.7	46.0	0 16.9	124	20 32.9	− 85
9	234 29.7	321 58.3	•• 35.4	19 53.0	•• 36.4	156 19.0	•• 31.8	18 37.9	•• 46.0	14 48.3	122	•20 41.4	− 83
10	249 32.1	336 57.3	35.4	34 54.0	36.9	171 21.8	31.8	33 40.2	46.1	29 19.5	122	20 49.7	− 84
11	264 34.6	351 56.3	35.5	49 55.0	37.4	186 24.5	31.7	48 42.5	46.1	43 50.7	121	20 58.1	− 82
12	279 37.1	6 55.4	−23 35.5	64 56.0	−12 37.9	201 27.3	+22 31.7	63 44.8	−11 46.2	58 21.8	120	−21 06.3	− 81
13	294 39.5	21 54.4	35.5	79 57.1	38.4	216 30.1	31.7	78 47.0	46.3	72 52.8	119	21 14.4	− 80
14	309 42.0	36 53.4	35.6	94 58.1	38.9	231 32.9	31.7	93 49.3	46.3	87 23.7	119	21 22.4	− 80
15	324 44.4	51 52.5	•• 35.6	109 59.1	•• 39.3	246 35.7	•• 31.7	108 51.6	•• 46.4	101 54.6	117	•21 30.4	− 78
16	339 46.9	66 51.5	35.7	125 00.1	39.8	261 38.5	31.7	123 53.9	46.4	116 25.3	117	21 38.2	− 78
17	354 49.4	81 50.5	35.7	140 01.1	40.3	276 41.3	31.6	138 56.2	46.5	130 56.0	116	21 46.0	− 76
18	9 51.8	96 49.5	−23 35.7	155 02.2	−12 40.8	291 44.0	+22 31.6	153 58.4	−11 46.5	145 26.6	115	−21 53.6	− 76
19	24 54.3	111 48.6	35.8	170 03.2	41.3	306 46.8	31.6	169 00.7	46.6	159 57.1	114	22 01.2	− 74
20	39 56.8	126 47.6	35.8	185 04.2	41.8	321 49.6	31.6	184 03.0	46.6	174 27.5	114	22 08.6	− 74
21	54 59.2	141 46.6	•• 35.8	200 05.2	•• 42.3	336 52.4	•• 31.6	199 05.3	•• 46.7	188 57.9	112	•22 16.0	− 73
22	70 01.7	156 45.7	35.8	215 06.2	42.8	351 55.2	31.6	214 07.5	46.7	203 28.1	112	22 23.3	− 71
23	85 04.2	171 44.7	35.9	230 07.3	43.3	6 58.0	31.5	229 09.8	46.8	217 58.3	111	22 30.4	− 71
1 0	100 06.6	186 43.7	−23 35.9	245 08.3	−12 43.8	22 00.8	+22 31.5	244 12.1	−11 46.8	232 28.4	110	−22 37.5	− 70
1	115 09.1	201 42.7	35.9	260 09.3	44.3	37 03.5	31.5	259 14.4	46.9	246 58.4	109	22 44.5	− 68
2	130 11.5	216 41.8	35.9	275 10.3	44.8	52 06.3	31.5	274 16.7	46.9	261 28.3	108	22 51.3	− 68
3	145 14.0	231 40.8	•• 36.0	290 11.3	•• 45.3	67 09.1	•• 31.5	289 18.9	•• 47.0	275 58.1	108	•22 58.1	− 66
4	160 16.5	246 39.8	36.0	305 12.4	45.8	82 11.9	31.5	304 21.2	47.1	290 27.9	107	23 04.7	− 66
5	175 18.9	261 38.9	36.0	320 13.4	46.3	97 14.7	31.4	319 23.5	47.1	304 57.6	106	23 11.3	− 64
6	190 21.4	276 37.9	−23 36.0	335 14.4	−12 46.8	112 17.5	+22 31.4	334 25.8	−11 47.2	319 27.2	105	−23 17.7	− 63
7	205 23.9	291 36.9	36.0	350 15.4	47.3	127 20.2	31.4	349 28.1	47.2	333 56.7	104	23 24.0	− 63
8	220 26.3	306 36.0	36.1	5 16.4	47.8	142 23.0	31.4	4 30.3	47.3	348 26.1	103	23 30.3	− 61
9	235 28.8	321 35.0	•• 36.1	20 17.5	•• 48.3	157 25.8	•• 31.4	19 32.6	•• 47.3	2 55.4	103	•23 36.4	− 59
10	250 31.3	336 34.0	36.1	35 18.5	48.8	172 28.6	31.4	34 34.9	47.4	17 24.7	102	23 42.3	− 59
11	265 33.7	351 33.0	36.1	50 19.5	49.3	187 31.4	31.3	49 37.2	47.4	31 53.9	101	23 48.2	− 58
12	280 36.2	6 32.1	−23 36.1	65 20.5	−12 49.8	202 34.2	+22 31.3	64 39.5	−11 47.5	46 23.0	100	−23 54.0	− 56
13	295 38.7	21 31.1	36.1	80 21.5	50.2	217 36.9	31.3	79 41.7	47.5	60 52.0	100	23 59.6	− 56
14	310 41.1	36 30.1	36.1	95 22.6	50.7	232 39.7	31.3	94 44.0	47.6	75 21.0	98	24 05.2	− 54
15	325 43.6	51 29.2	•• 36.1	110 23.6	•• 51.2	247 42.5	•• 31.3	109 46.3	•• 47.6	89 49.8	98	•24 10.6	− 53
16	340 46.0	66 28.2	36.2	125 24.6	51.7	262 45.3	31.3	124 48.6	47.7	104 18.6	97	24 15.9	− 52
17	355 48.5	81 27.2	36.2	140 25.6	52.2	277 48.1	31.2	139 50.9	47.7	118 47.3	96	24 21.1	− 50
18	10 51.0	96 26.3	−23 36.2	155 26.6	−12 52.7	292 50.9	+22 31.2	154 53.1	−11 47.8	133 15.9	96	−24 26.1	− 50
19	25 53.4	111 25.3	36.2	170 27.7	53.2	307 53.6	31.2	169 55.4	47.8	147 44.5	94	24 31.1	− 48
20	40 55.9	126 24.3	36.2	185 28.7	53.7	322 56.4	31.2	184 57.7	47.9	162 12.9	94	24 35.9	− 47
21	55 58.4	141 23.3	•• 36.2	200 29.7	•• 54.2	337 59.2	•• 31.2	200 00.0	•• 47.9	176 41.3	93	•24 40.6	− 46
22	71 00.8	156 22.4	36.2	215 30.7	54.7	353 02.0	31.2	215 02.3	48.0	191 09.6	93	24 45.2	− 44
23	86 03.3	171 21.4	36.2	230 31.7	55.2	8 04.8	31.1	230 04.5	48.1	205 37.9	91	24 49.6	− 43
24	101 05.8	186 20.4	−23 36.2	245 32.8	−12 55.7	23 07.5	+22 31.1	245 06.8	−11 48.1	220 06.0	91	−24 53.9	− 42
code	—	− 10	0	+ 11	− 5	+ 28	0	+ 22	− 1				

GMT	h	SUN GHA ° ′	SUN Dec. ° ′
30	0	179 25.6	−23 12.3
	1	194 25.3	12.1
	2	209 25.0	12.0
	3	224 24.7	·· 11.8
	4	239 24.4	11.7
	5	254 24.1	11.5
	6	269 23.8	−23 11.3
	7	284 23.5	11.2
	8	299 23.2	11.0
	9	314 22.9	·· 10.9
	10	329 22.6	10.7
	11	344 22.3	10.5
	12	359 22.0	−23 10.4
	13	14 21.7	10.2
	14	29 21.4	10.1
	15	44 21.1	·· 09.9
	16	59 20.8	09.7
	17	74 20.5	09.6
	18	89 20.2	−23 09.4
	19	104 19.9	09.2
	20	119 19.6	09.0
	21	134 19.3	·· 08.9
	22	149 19.0	08.7
	23	164 18.7	08.5
31	0	179 18.4	−23 08.4
	1	194 18.1	08.2
	2	209 17.8	08.0
	3	224 17.5	·· 07.8
	4	239 17.2	07.7
	5	254 16.9	07.5
	6	269 16.6	−23 07.3
	7	284 16.3	07.1
	8	299 16.0	07.0
	9	314 15.7	·· 06.8
	10	329 15.4	06.6
	11	344 15.1	06.4
	12	359 14.8	−23 06.2
	13	14 14.5	06.0
	14	29 14.2	05.9
	15	44 13.9	·· 05.7
	16	59 13.6	05.5
	17	74 13.3	05.3
	18	89 13.0	−23 05.1
	19	104 12.7	04.9
	20	119 12.4	04.7
	21	134 12.1	·· 04.6
	22	149 11.8	04.4
	23	164 11.5	04.2
1	0	179 11.2	−23 04.0
	1	194 10.9	03.8
	2	209 10.6	03.6
	3	224 10.3	·· 03.4
	4	239 10.0	03.2
	5	254 09.7	03.0
	6	269 09.4	−23 02.8
	7	284 09.1	02.6
	8	299 08.8	02.4
	9	314 08.5	·· 02.2
	10	329 08.2	02.0
	11	344 07.9	01.8
	12	359 07.6	−23 01.6
	13	14 07.3	01.4
	14	29 07.0	01.2
	15	44 06.7	·· 01.0
	16	59 06.4	00.8
	17	74 06.1	00.6
	18	89 05.8	−23 00.4
	19	104 05.5	00.2
	20	119 05.2	23 00.0
	21	134 04.9	·22 59.8
	22	149 04.6	59.6
	23	164 04.3	59.3
24		179 04.0	−22 59.1
code		−	+ 2

STARS No.	Name	SHA ° ′	Dec. ° ′
7	Acamar	315 51.8	−40 29.4
5	Achernar	335 59.5	−57 28.4
30	Acrux	173 59.4	−62 50.5
19	Adhara	255 47.2	−28 54.5
10	Aldebaran	291 40.3	+16 25.2
32	Alioth	166 59.6	+56 12.1
34	Alkaid	153 34.0	+49 32.2
55	Al Na'ir	28 39.8	−47 11.2
15	Alnilam	276 31.3	− 1 13.7
25	Alphard	218 39.6	− 8 27.5
41	Alphecca	126 49.0	+26 51.9
1	Alpheratz	358 29.8	+28 50.4
51	Altair	62 52.0	+ 8 44.7
2	Ankaa	353 59.5	−42 33.5
42	Antares	113 21.3	−26 19.9
37	Arcturus	146 36.5	+19 25.0
43	Atria	109 03.8	−68 56.7
22	Avior	234 35.8	−59 21.5
13	Bellatrix	279 19.5	+ 6 18.6
16	Betelg'se	271 49.2	+ 7 24.1
17	Canopus	264 15.4	−52 40.2
12	Capella	281 39.9	+45 57.4
53	Deneb	50 02.4	+45 07.0
28	Denebola	183 19.0	+14 49.5
4	Diphda	349 40.5	−18 14.3
27	Dubhe	194 45.7	+61 59.6
14	Elnath	279 08.6	+28 34.3
47	Eltanin	91 07.4	+51 29.5
54	Enif	34 31.1	+ 9 39.9
56	Fomalhaut	16 13.2	−29 52.1
31	Gacrux	172 50.8	−56 51.2
29	Gienah	176 38.2	−17 17.2
35	Hadar	149 51.6	−60 09.0
6	Hamal	328 51.0	+23 15.0
48	Kaus Aust.	84 43.3	−34 24.6
40	Kochab	137 18.3	+74 20.2
57	Markab	14 22.9	+14 57.6
8	Menkar	315 01.5	+ 3 54.7
36	Menkent	149 00.4	−36 08.6
24	Miapl'dus	221 48.7	−69 31.5
9	Mirfak	309 44.0	+49 42.2
50	Nunki	76 53.9	−26 21.4
52	Peacock	54 29.8	−56 53.2
21	Pollux	244 21.8	+28 08.3
20	Procyon	245 46.0	+ 5 20.6
46	R'alhague	96 48.2	+12 35.4
26	Regulus	208 30.7	+12 11.4
11	Rigel	281 54.6	− 8 15.2
38	Rigil Kent.	140 53.2	−60 38.7
44	Sabik	103 04.0	−15 40.2
3	Schedar	350 31.6	+56 17.5
45	Shaula	97 22.9	−37 04.4
18	Sirius	259 12.6	−16 39.1
33	Spica	159 18.3	−10 55.4
23	Suhail	223 25.0	−43 14.7
49	Vega	81 09.6	+38 44.3
39	Zub'g'bi	137 55.0	−15 51.2

GMT h	Equation of Time (App.—Mean) 30 m s	31 m s	1 m s
0	− 2 16.9	− 2 46.0	− 3 14.7
6	− 2 24.2	− 2 53.2	− 3 21.9
12	− 2 31.5	− 3 00.4	− 3 29.0
18	− 2 38.7	− 3 07.6	− 3 36.1
24	− 2 46.0	− 3 14.7	− 3 43.2

Lat. N °	Sunrise h m	Twlt. begins h m	Moonrise 30 h m	31 h m	1 h m	h m
72	▬	6 55	5 31	▬	▬	
70	▬	6 46	4 42	▬	▬	
68	▬	6 39	4 12	6 24	▬	
66	10 30	6 33	3 49	5 39	8 03	
64	9 51	6 28	3 32	5 10	6 57	
62	9 24	6 23	3 17	4 48	6 22	
60	9 03	6 18	3 05	4 30	5 56	
58	8 46	6 14	2 55	4 15	5 36	
56	8 32	6 10	2 46	4 03	5 20	
54	8 19	6 06	2 38	3 52	5 06	
52	8 08	6 02	2 31	3 42	4 54	
50	7 59	6 00	2 24	3 33	4 43	
45	7 38	5 51	2 10	3 15	4 21	
40	7 22	5 45	1 59	3 00	4 03	
35	7 08	5 37	1 49	2 48	3 48	
30	6 56	5 30	1 41	2 37	3 35	
20	6 35	5 15	1 27	2 19	3 13	
10	6 17	5 01	1 14	2 02	2 54	
0	5 59	4 44	1 03	1 48	2 36	
10	5 42	4 24	0 51	1 33	2 18	
20	5 23	3 59	0 39	1 17	1 59	
30	5 01	3 25	0 25	0 59	1 38	
35	4 49	3 02	0 17	0 48	1 25	
40	4 34	2 31	0 08	0 36	1 11	
45	4 16	1 44	24 22	0 22	0 54	
50	3 54	////	24 05	0 05	0 33	
52	3 43	////	23 58	24 23	0 23	
54	3 31	////	23 49	24 11	0 11	
56	3 17	////	23 39	23 59	24 28	
58	3 01	////	23 27	23 44	24 09	
60	2 41	////	23 15	23 26	23 47	
S						

Lat. N °	Sunset h m	Twlt. ends h m	Moonset 30 h m	31 h m	1 h m	h m
72	▬	17 11	8 36	▬	▬	
70	▬	17 20	9 26	▬	▬	
68	▬	17 27	9 58	9 20	▬	
66	13 36	17 33	10 22	10 06	9 24	
64	14 15	17 38	10 40	10 36	10 31	
62	14 42	17 43	10 56	10 59	11 06	
60	15 03	17 48	11 09	11 17	11 32	
58	15 20	17 52	11 20	11 33	11 52	
56	15 35	17 56	11 30	11 46	12 09	
54	15 47	18 00	11 38	11 57	12 24	
52	15 58	18 03	11 46	12 08	12 36	
50	16 08	18 07	11 53	12 17	12 47	
45	16 28	18 14	12 08	12 36	13 10	
40	16 44	18 21	12 21	12 52	13 29	
35	16 58	18 29	12 31	13 05	13 45	
30	17 10	18 35	12 40	13 17	13 58	
20	17 31	18 50	12 57	13 37	14 21	
10	17 50	19 05	13 11	13 54	14 41	
0	18 07	19 22	13 24	14 10	15 00	
10	18 24	19 41	13 37	14 27	15 19	
20	18 43	20 07	13 51	14 44	15 39	
30	19 04	20 40	14 08	15 05	16 03	
35	19 17	21 03	14 17	15 17	16 16	
40	19 32	21 34	14 28	15 30	16 32	
45	19 50	22 20	14 41	15 47	16 51	
50	20 12	////	14 57	16 07	17 15	
52	20 22	////	15 05	16 16	17 27	
54	20 34	////	15 13	16 27	17 40	
56	20 48	////	15 22	16 39	17 55	
58	21 04	////	15 33	16 54	18 13	
60	21 24	////	15 45	17 10	18 35	
S						

GMT of Transit Meridian of Greenwich

DAY	Moon h m	Venus h m	Mars h m	Jupiter h m	Saturn h m
30	7 13	11 31	7 42	22 37	7 49
31	7 59	11 32	7 41	22 32	7 46
1	8 48	11 34	7 39	22 28	7 42

ADDITIONAL ALTITUDE CORRECTIONS

Alt. °	Sun's Low'r Limb Add ′	Venus Add ′	Mars Add ′
0	0.6	0.1	0.1
30	0.6	0.1	0.1
45	0.6	0.1	0.0
60	0.6	0.0	0.0
75	0.6	0.0	0.0
90			

Moon's Lower Limb **Add**

Alt. °	30 ′	31 ′	1 ′
0	12.4	12.9	13.5
4	12.4	12.9	13.5
8	12.4	12.9	13.5
12	12.4	12.9	13.6
16	12.5	13.0	13.6
20	12.6	13.0	13.6
24	12.6	13.1	13.7
28	12.7	13.2	13.7
32	12.8	13.2	13.8
36	12.9	13.3	13.9
40	13.0	13.4	13.9
44	13.1	13.5	14.0
48	13.3	13.6	14.1
52	13.4	13.7	14.2
56	13.5	13.9	14.3
60	13.7	14.0	14.4
64	13.9	14.1	14.5
68	14.0	14.3	14.6
72	14.2	14.4	14.7
76	14.4	14.5	14.8
80	14.5	14.7	14.9
84	14.7	14.8	15.0
88	14.8	14.9	15.1
90			

Add to table, back cover

Moon's Upper Limb **Subtract**

Alt. °	30 ′	31 ′	1 ′
0	17.4	17.1	16.7
4	17.4	17.1	16.7
8	17.3	17.0	16.7
12	17.3	17.0	16.7
16	17.2	17.0	16.6
20	17.2	16.9	16.6
24	17.1	16.9	16.6
28	17.0	16.8	16.5
32	16.9	16.7	16.4
36	16.8	16.6	16.4
40	16.7	16.5	16.3
44	16.6	16.4	16.2
48	16.5	16.3	16.1
52	16.3	16.2	16.1
56	16.2	16.1	16.0
60	16.0	16.0	15.9
64	15.9	15.8	15.8
68	15.7	15.7	15.7
72	15.6	15.6	15.6
76	15.4	15.4	15.4
80	15.2	15.3	15.3
84	15.0	15.1	15.2
88	14.9	15.0	15.1
90			

Subtract from table, back cover

EXPLANATION AND EXAMPLES

1. Object. The object of this volume is to provide in convenient form the astronomical data required by mariners. In the front part of the book two facing pages give complete data for every hour of three days. The yellow pages give 60 tables, one for every minute of the hour. Each table has two parts. One part (consisting of the first four columns) has 61 lines, one for every second of the minute, used to bring the hourly value of the Greenwich hour angle (GHA) up to the minute and second of observation. The other part (making up the last three columns), with 181 values, is for use in bringing the hourly value of the declination up to the minute of observation; and also for obtaining small corrections to the GHA of the planets and Moon. Altitude correction tables are on the covers, and small additional altitude corrections for the Sun, Moon, Venus, and Mars are on the daily pages.

2. Sun, Moon, planets and *Vernal equinox* (♈). The daily pages give the GHA and Dec. of the Sun, Moon, and four planets at 1-hour intervals, and also a code at the foot of the column (at the right for the Moon) to be used with the yellow table, except for the GHA of the Sun and (♈), where no code is needed. The sign of the code correction is the sign attached to the code on the daily pages; for the Moon's GHA the sign (not printed) is always plus. The magnitudes of the planets are given in the headings.

Example: For 1953 January 2, $16^h\ 23^m\ 12^s$, Greenwich mean time, find the GHA and Dec. of the Sun.

	GHA	Dec.	code
	° ′	° ′	
(From daily page for Jan. 1, 2, 3) Jan. 2, 16^h	58 57.7	−22 54.4	+2
(From yellow table 23^m, Sun, 12^s) $23^m\ 12^s$	5 48.0		
(From yellow table 23^m, code 2) code correction		+0.1	
The required GHA and Dec.	64 45.7	−22 54.3	

Example: For 1953 January 3, $7^h\ 12^m\ 49^s$ GMT, find the GHA and Dec. of Venus.

	GHA	code	Dec.	code
	° ′		° ′	
(From daily page for Jan. 1, 2, 3) Jan. 3, 7^h	237 20.3	−3	−13 48.5	+11
(From yellow table 12^m, planets, 49^s) $12^m\ 49^s$	3 12.3			
(From yellow table 12^m, codes 3 and 11) code correction	−0.1		+0.2	
The required GHA and Dec.	240 32.5		−13 48.3	

Example: For 1953 March 28, $14^h\ 14^m\ 27^s$ GMT, find the GHA and Dec. of the Moon.

	GHA ° ′	code	Dec. ° ′	code
(From daily page for Mar. 26, 27, 28) Mar. 28, 14^h	229 31.9	+170	+2 44.1	−134
(From yellow table 14^m, Moon, 27^s) $14^m\ 27^s$	3 26.9			
(From yellow table 14^m, codes 170 and 134) code correction	+4.1		−3.2	
The required GHA and Dec.	233 02.9		+2 40.9	

3. Stars. The GHA of a star is found by adding the GHA of the vernal equinox to the star's sidereal hour angle:

$$\text{GHA*} = \text{GHA}\Upsilon + \text{SHA*}.$$

On the right-hand daily pages are given the SHA, Dec., and names of 57 stars. The data are for the middle of the second day. The SHA and Dec. may be used without appreciable error for three days. The names and magnitudes of the stars are given inside the front cover, and also on the outside of the back cover.

Example: For 1953 January 2, $17^h\ 44^m\ 19^s$ GMT, find the GHA and Dec. of star 12, Capella.

	GHA ° ′	Dec. ° ′
(From daily page for Jan. 1, 2, 3) SHA and Dec.	281 41.1	+45 57.3
(From daily page for Jan. 1, 2, 3) GHA ♈, Jan. 2, 17^h	357 01.9	
(From yellow table 44^m, ♈, 19^s) $44^m\ 19^s$	11 06.6	
The required GHA, rejecting 360°	289 49.6	

The Greenwich mean time of transit over the meridian of Greenwich may be obtained, if desired, by finding the GMT at which GHA♈ is the same as 360° − SHA*.

The SHA, Dec., and magnitude of 172 stars (including the 57 standard stars) are given for the middle of each month on pages 254–259.

4. Altitude Corrections. Three altitude corrections are given, except for the stars, Jupiter, and Saturn, where only two are needed. The correction for *height of eye,* used for all objects, is inside the front cover. For the *Sun's lower limb,* use also the correction from the Sun table inside the front cover and add the small additional correction from the daily page. For *stars* and *planets* use (in addition to the dip correction) the correction from the star and planet table inside the front cover, and for *Venus* and *Mars* add the small additional correction from the daily page. For the *Moon,* use (in addition to the dip correction) the correction from the Moon table inside the back cover and apply the additional limb correction from the daily page; the limb corrections are given for 12^h GMT of each day, and may be taken directly out of the table without interpolation.

Example: Correct the following observed altitudes, taken at height 35 feet on 1953 August 3.

	Sun (lower limb)	Moon (upper limb)	Moon (lower limb)	Venus	Polaris
	° ′	° ′	° ′	° ′	° ′
Observed altitude	40 25.5	25 11.7	29 40.1	41 13.6	15 49.3
Height of eye	− 5.6	− 5.6	− 5.6	− 5.6	− 5.6
Cover tables	+14.7	+49.5	+47.8	− 1.1	− 3.4
(From daily page) additional correction	+ 0.1	−15.0	+16.5	+ 0.1	
Corrected altitude	40 34.7	25 40.6	30 38.8	41 07.0	15 40.3

Caution. In H. O. 218 and in the preliminary edition of H. O. 249, refraction at a height of eye of 5000 feet is already included, and the altitude corrections in this book are not to be used.

Sun's upper limb and *Bubble sextant observations.* If the upper limb of the Sun is observed, correct the altitude as if the lower limb had been observed, and apply the additional correction from the table below.

ADDITIONAL CORRECTION FOR SUN'S UPPER LIMB

(to be applied to the correction for the lower limb)

Dates	Correction	Dates
	′	
Jan. 1 to Jan. 26	−33.8	Dec. 11 to Dec. 31
Jan. 27 to Feb. 14	−33.7	Nov. 22 to Dec. 10
Feb. 15 to Feb. 28	−33.6	Nov. 8 to Nov. 21
Mar. 1 to Mar. 11	−33.5	Oct. 27 to Nov. 7
Mar. 12 to Mar. 23	−33.4	Oct. 16 to Oct 26
Mar. 24 to Apr. 3	−33.3	Oct. 5 to Oct. 15
Apr. 4 to Apr. 13	−33.2	Sept. 24 to Oct. 4
Apr. 14 to Apr. 25	−33.1	Sept. 13 to Sept. 23
Apr. 26 to May 8	−33.0	Aug. 31 to Sept. 12
May 9 to May 23	−32.9	Aug. 16 to Aug. 30
May 24 to June 15	−32.8	July 24 to Aug. 15
June 16 to July 23	−32.7	

If the center of the Sun or Moon is observed with a bubble sextant, calculate the correction for the two limbs separately, and take the average of the two results; in the case of the Sun, add 0.′6 to this average.

5. Latitude from Polaris. The tables on the last white page and the first yellow page give three corrections which must be applied to a corrected altitude of Polaris to get the latitude. All three tables depend on the local hour angle of the vernal equinox. The second table depends also on the date and the third on the corrected altitude.

Example: On 1953 January 3, $13^h\ 45^m\ 35^s$ GMT in longitude 74° West the observed altitude of Polaris was 15° 49.′3. Find the latitude.

	° ′
(From the daily page for Jan. 1, 2, 3) GHA ♈, Jan. 3, 13^h	297 51.2
(From yellow table 45^m, ♈, 35^s) 45^m 35^s	11 25.6
GHA ♈	309 16.8
Longitude west (subtract)	74 00.0
LHA ♈	235 16.8
	° ′
Corrected altitude (from example of section 4)	15 40.3
Correction for LHA ♈, 235°.3	+50.6
Correction for LHA ♈ and date	0.0
Correction for LHA ♈ and corrected altitude	− 0.1
Latitude	16 30.8

The page preceding the other Polaris tables gives the azimuth, depending on LHA ♈ and the latitude.

6. Sunrise, sunset, twilight, moonrise, moonset. Data for finding these for latitudes between 60° south and 72° north are given on the right-hand daily pages. Sunrise, sunset, and the beginning and ending of astronomical twilight are given for the middle day; they are sufficiently accurate for three days. Moonrise and moonset are given for four days for the Greenwich meridian in order to facilitate estimation of times for other longitudes. All times in these columns are local civil times. The precise time of moonrise or moonset is seldom needed; a glance at the table will usually show whether the Moon is up, and favorably placed for observation. If needed, however, the precise time may be obtained as follows. Interpolate for latitude on the day wanted, and also on the preceding day in east longitudes, or the following day in west longitudes. Take the difference between the two results, multiply it by the longitude divided by 360°, and apply the product to the datum for the day wanted, so as to bring the result between the two results previously found.

Example: Find the time of moonrise on 1953 January 3, in longitude 60° west, latitude 42° north.

	h m
January 3, Greenwich, latitude 42° north	20 01
January 4, Greenwich, latitude 42° north	21 03
Difference	62
Correction for longitude, $\frac{60}{360}\times 62$	10
Local civil time of moonrise	20 11
GMT of moonrise (60°=4^h)	24 11

The times of moonrise and moonset are sometimes greater than 24^h. This means that the phenomenon really occurs on the following day but the time is given in this form if the preceding date is not filled with a symbol of no phenomenon, to facilitate the interpolation for longitude. For any given meridian the time of moonrise or moonset is about an hour later (on the average) each succeeding day. If then, on a given day, one of these phenomena occurs shortly before midnight, the next one will occur about 25 hours later which carries it over into the second day.

Some of the phenomena do not occur in high latitudes during certain periods. The symbols used to indicate the exceptions are:

□, Sun or Moon does not set but remains continuously above the horizon.

■, Sun or Moon does not rise but remains continuously below the horizon.

////, Twilight lasts all night.

7. Equation of time. This is given on the right-hand daily pages, at intervals of 6 hours. It is to be applied to mean time in order to obtain apparent time.

8. Meridian transit of Moon and planets. The GMT of transit of the Moon and planets over the meridian of Greenwich is given for every day on the right-hand daily pages. The LMT of transit over another meridian may be obtained as described for moonrise in section 6.

9. Accuracy. Although the quantities in this volume are given to tenths of minutes, in general the GHA and Dec. of an object cannot actually be obtained accurate to 0′.1. The chief reason for loss of accuracy is the error of rounding off; any quantity given to 0′.1 is necessarily subject to an error that may be as large as 0′.05. When several such quantities are added together the errors of rounding may accumulate.

In general, the largest error that can occur in a GHA or Dec. taken from this volume is about 0′.2. In practice it may be expected that two-thirds of the quantities taken out will have errors less than 0′.1, and one-third will have errors between 0′.1 and 0′.2.

In the case of the Sun's GHA the error will on occasions be 0′.1 greater than the figures just given, owing to neglecting the code. This last error has been minimized by adjusting the printed GHA in such a way as to spread the error through the hour.

10. Using the 1953 Almanac in 1954. This volume may be used in 1954 for the Sun and stars, with errors generally less than 0′.4, in the following way.

Calculate the GHA of a star for the same date and time and subtract 15′.1. Take out the Dec. of a star for the same date.

For the Sun's GHA use the same date and time and apply the correction from table on page 253.

Take out the Sun's Dec. for a time $5^h\ 49^m$ earlier than the time of observation.

11. Right ascension. The right ascensions of objects are not needed in navigation. They may, however, be obtained if desired from the data in this volume.

The right ascension of a star is obtained by subtracting the SHA from 360°, and converting from arc to time by the table on page 260.

Example: Find the right ascension of star 12 Capella on 1953 January 3.

		° ′
		360 00.0
(From daily page for Jan. 1, 2, 3) SHA		281 41.1
Difference		78 18.9

			s
78°	5^h	12^m	00.0
18′		1	12.0
0′.9 or 54″			03.6
right ascension	5^h	13^m	$15^s.6$

The right ascension of the Sun, Moon, or a planet may be obtained by subtracting the GHA of the object from GHA ♈, and converting from arc to time.

Example: Find the right ascension of the Moon on 1953, March 28, $14^h\ 14^m\ 27^s$ GMT.

	♈	Moon	Code
	° ′	° ′	
(From the daily page for Mar. 26, 27, 28) Mar. 28, 14^h	35 41.3	229 31.9	+170
(From the yellow table 14^m, 27^s) $14^m\ 27^s$	3 37.3	3 26.9	
(From yellow table 14^m, code 170) code correction		4.1	
GHA	39 18.6	233 02.9	

		° ′
Difference		166 15 .7
	166°	$11^h\ 04^m\ 00^s.0$
	15′	1 00 .0
	0′.7 or 42″	02 .8
	Right ascension	$11^h\ 05^m\ 02^s.8$

SUN'S GHA IN 1954

Apply to 1953 value to obtain 1954 value for same date and GMT.

		′			′			′			′			′
Jan.	2	+1.7	Mar.	5	−0.8	June	12	+0.7	Aug.	27	−1.0	Nov.	10	+0.5
	3	+1.6		7	−0.9		14	+0.8		28	−1.1		11	+0.6
	5	+1.5		10	−1.0		16	+0.9		30	−1.2		12	+0.7
	7	+1.4		14	−1.1		19	+1.0	Sept.	3	−1.3		14	+0.8
	9	+1.3		18	−1.0		23	+1.1		7	−1.4		15	+0.9
	22	+1.2		31	−0.9		26	+1.0		11	−1.3		18	+1.0
	24	+1.1	Apr.	3	−1.0		27	+0.9		25	−1.2		25	+1.1
	26	+1.0		11	−1.1		29	+0.8	Oct.	5	−1.3		30	+1.2
	28	+0.9		13	−1.0	July	1	+0.7		7	−1.2	Dec.	2	+1.3
	29	+0.8		15	−0.9		3	+0.6		8	−1.1		4	+1.4
	30	+0.7		16	−0.8		20	+0.5		10	−1.0		5	+1.5
	31	+0.6		18	−0.7		22	+0.4		11	−0.9		6	+1.6
Feb.	2	+0.5		20	−0.6		24	+0.3		13	−0.8		8	+1.7
	3	+0.4		22	−0.5		26	+0.2		14	−0.7		9	+1.8
	4	+0.3	May	7	−0.4		27	+0.1		16	−0.6		10	+1.9
	5	+0.2		10	−0.3		28	0.0		19	−0.5		12	+2.0
	7	+0.1		11	−0.2		29	−0.1		29	−0.4		15	+2.1
	9	0.0		13	−0.1		31	−0.2		31	−0.3		18	+2.2
	13	−0.1		14	0.0	Aug.	1	−0.3	Nov.	2	−0.2		21	+2.1
	22	−0.2		16	+0.1		3	−0.4		4	−0.1		23	+2.0
	25	−0.3		17	+0.2		6	−0.5		5	0.0		26	+1.9
	27	−0.4		18	+0.3		19	−0.6		6	+0.1		28	+1.8
	28	−0.5		20	+0.4		22	−0.7		7	+0.2		32	+1.7
Mar.	2	−0.6		22	+0.5		24	−0.8		8	+0.3			
	4	−0.7	June	10	+0.6		25	−0.9		9	+0.4			

For a date given in the table, use the upper of the two possible values.

Mag.	Name and No.		SHA							Declination						
				Jan.	Feb.	Mar.	Apr.	May	June		Jan.	Feb.	Mar.	Apr.	May	June
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
2.2	Alpheratz	1	358	30.7	30.8	30.8	30.7	30.5	30.2	+28	50.1	50.0	49.9	49.9	49.9	49.9
2.4	β Cassiopeiæ		358	20.3	20.5	20.6	20.5	20.2	19.8	+58	53.8	53.7	53.6	53.4	53.4	53.4
2.9	γ Pegasi		357	17.7	17.8	17.8	17.7	17.6	17.3	+14	55.5	55.4	55.4	55.4	55.4	55.5
2.9	β Hydri §		354	10.1	10.6	10.9	10.8	10.4	09.7	−77	31.3	31.2	31.0	30.9	30.7	30.6
2.4	Ankaa	2	354	00.3	00.4	00.5	00.4	00.3	00.0	−42	33.8	33.7	33.6	33.5	33.3	33.2
2.5	Schedar	3	350	32.7	32.8	32.9	32.9	32.6	32.3	+56	17.2	17.1	17.0	16.8	16.8	16.8
2.2	Diphda	4	349	41.4	41.4	41.5	41.4	41.3	41.1	−18	14.7	14.7	14.6	14.6	14.4	14.3
Var.*	γ Cassiopeiæ		346	32.2	32.4	32.6	32.5	32.3	31.9	+60	28.1	28.1	28.0	27.8	27.7	27.7
2.4	β Andromedæ		343	13.5	13.6	13.7	13.6	13.5	13.2	+35	22.6	22.5	22.5	22.4	22.4	22.4
2.8	δ Cassiopeiæ		339	19.1	19.3	19.5	19.5	19.3	18.9	+59	59.9	59.8	59.7	59.6	59.5	59.5
0.6	Achernar	5	336	00.2	00.4	00.6	00.6	00.5	00.3	−57	28.7	28.6	28.5	28.3	28.2	28.0
2.1	Polaris		332	18.7	27.9	34.8	37.1	33.8	26.0	+89	03.1	03.1	03.0	02.8	02.7	02.6
2.7	β Arietis		331	59.2	59.3	59.4	59.4	59.3	59.1	+20	34.9	34.9	34.9	34.8	34.8	34.9
3.0	α Hydri		330	40.3	40.6	40.8	40.9	40.8	40.6	−61	48.1	48.0	47.9	47.7	47.5	47.4
2.2	γ Andromedæ		329	44.7	44.8	44.9	45.0	44.8	44.6	+42	06.6	06.6	06.5	06.4	06.4	06.4
2.2	Hamal	6	328	52.0	52.1	52.2	52.2	52.1	51.9	+23	14.7	14.7	14.6	14.6	14.6	14.6
3.1	β Trianguli		328	18.7	18.8	18.9	18.9	18.8	18.6	+34	46.2	46.2	46.1	46.1	46.0	46.0
3.1	Acamar	7	315	52.4	52.6	52.8	52.9	52.8	52.7	−40	29.6	29.6	29.6	29.5	29.3	29.2
2.8	Menkar	8	315	02.4	02.5	02.6	02.6	02.6	02.4	+ 3	54.5	54.5	54.5	54.5	54.5	54.6
Var.†	β Persei		313	43.1	43.2	43.3	43.4	43.4	43.2	+40	46.9	46.9	46.8	46.7	46.7	46.6
1.9	Mirfak	9	309	45.2	45.4	45.5	45.6	45.6	45.4	+49	42.1	42.1	42.0	42.0	41.9	41.8
3.0	η Tauri		303	49.3	49.4	49.5	49.6	49.5	49.4	+23	57.9	57.9	57.8	57.8	57.8	57.8
2.9	ζ Persei		302	12.0	12.1	12.2	12.3	12.3	12.1	+31	45.0	45.0	45.0	44.9	44.9	44.8
3.0	ε Persei		301	19.1	19.2	19.4	19.5	19.5	19.3	+39	52.8	52.8	52.8	52.8	52.7	52.6
3.2	γ Eridani		301	02.1	02.2	02.3	02.4	02.4	02.3	−13	38.4	38.5	38.5	38.4	38.4	38.2
1.1	Aldebaran	10	291	41.2	41.3	41.4	41.5	41.5	41.4	+16	25.1	25.1	25.1	25.1	25.1	25.1
2.9	ι Aurigæ §		286	30.5	30.6	30.7	30.8	30.9	30.8	+33	05.8	05.8	05.8	05.8	05.7	05.7
2.9	β Eridani		283	36.5	36.5	36.6	36.8	36.8	36.7	− 5	08.7	08.7	08.8	08.7	08.7	08.6
0.3	Rigel	11	281	55.3	55.4	55.5	55.7	55.7	55.7	− 8	15.2	15.3	15.3	15.3	15.2	15.1
0.2	Capella	12	281	41.1	41.2	41.4	41.5	41.6	41.5	+45	57.4	57.4	57.4	57.4	57.3	57.2
1.7	Bellatrix	13	279	20.4	20.4	20.5	20.6	20.7	20.6	+ 6	18.6	18.6	18.6	18.6	18.6	18.6
1.8	Elnath	14	279	09.6	09.7	09.8	09.9	10.0	09.9	+28	34.3	34.3	34.3	34.3	34.3	34.3
3.0	β Leporis		278	26.0	26.1	26.3	26.4	26.5	26.4	−20	47.7	47.8	47.8	47.8	47.7	47.6
2.5	δ Orionis		277	35.4	35.5	35.6	35.7	35.8	35.7	− 0	19.9	19.9	19.9	19.9	19.9	19.8
2.7	α Leporis		277	19.7	19.7	19.9	20.0	20.1	20.0	−17	51.3	51.3	51.4	51.3	51.3	51.2
2.9	ι Orionis		276	42.5	42.6	42.7	42.8	42.9	42.8	− 5	56.3	56.4	56.4	56.4	56.3	56.3
1.8	Alnilam	15	276	32.1	32.1	32.3	32.4	32.4	32.4	− 1	13.8	13.8	13.8	13.8	13.8	13.7
3.0	ζ Tauri		276	16.9	17.0	17.1	17.2	17.3	17.2	+21	07.1	07.1	07.1	07.0	07.0	07.0
2.8	α Columbæ		275	30.3	30.4	30.6	30.7	30.8	30.8	−34	05.9	06.0	06.0	06.0	05.9	05.8
1.9	ζ Orionis		275	23.7	23.8	23.9	24.0	24.0	24.0	− 1	57.9	58.0	58.0	58.0	57.9	57.9
2.2	κ Orionis		273	36.6	36.6	36.8	36.9	37.0	36.9	− 9	41.1	41.1	41.2	41.1	41.1	41.0
Var.‡	Betelgeuse	16	271	50.1	50.1	50.2	50.3	50.4	50.4	+ 7	24.1	24.0	24.0	24.0	24.0	24.1
2.1	β Aurigæ		270	58.0	58.1	58.3	58.4	58.5	58.5	+44	56.9	56.9	56.9	56.9	56.9	56.8
2.7	θ Aurigæ		270	51.6	51.6	51.8	51.9	52.0	52.0	+37	12.8	12.9	12.9	12.9	12.8	12.8
2.0	β Canis Majoris		264	50.0	50.1	50.2	50.3	50.4	50.4	−17	55.9	56.0	56.0	56.0	55.9	55.9
−0.9	Canopus	17	264	15.8	15.9	16.1	16.4	16.6	16.7	−52	40.2	40.3	40.4	40.4	40.3	40.2
1.9	γ Geminorum		261	14.4	14.5	14.6	14.7	14.8	14.8	+16	26.5	26.5	26.5	26.5	26.5	26.5
−1.6	Sirius	18	259	13.3	13.4	13.5	13.6	13.7	13.7	−16	39.0	39.1	39.2	39.2	39.1	39.0
2.8	τ Puppis		257	47.9	48.0	48.2	48.4	48.6	48.7	−50	33.5	33.6	33.7	33.7	33.7	33.5
1.6	Adhara	19	255	47.8	47.8	48.0	48.1	48.2	48.3	−28	54.4	54.5	54.6	54.6	54.6	54.5
3.1	ο Canis Majoris		254	43.5	43.6	43.7	43.8	44.0	44.0	−23	45.8	45.9	46.0	46.0	45.9	45.9
2.0	δ Canis Majoris		253	22.3	22.3	22.4	22.6	22.7	22.7	−26	19.0	19.2	19.2	19.2	19.2	19.1
2.7	π Puppis		251	07.2	07.3	07.4	07.6	07.7	07.8	−37	00.7	00.9	00.9	01.0	00.9	00.8
2.4	η Canis Majoris		249	25.9	26.0	26.1	26.2	26.4	26.4	−29	12.6	12.7	12.8	12.8	12.8	12.7
3.1	β Canis Minoris		248	50.4	50.4	50.4	50.6	50.7	50.7	+ 8	23.1	23.1	23.1	23.1	23.1	23.1
3.3	σ Puppis		248	03.4	03.4	03.5	03.7	03.9	04.0	−43	12.3	12.5	12.6	12.6	12.6	12.4
1.6	α Geminorum		247	05.2	05.2	05.3	05.5	05.6	05.6	+31	59.6	59.6	59.7	59.7	59.7	59.7

*Irregular variable; 1950 Mag. 2.5. †2.3—3.5. ‡0.1—1.2. §Not suitable for use with H. O. 214.

Mag.	Name and No.		SHA							Declination						
				July	Aug.	Sept.	Oct.	Nov.	Dec.		July	Aug.	Sept.	Oct.	Nov.	Dec.
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
2.2	Alpheratz	1	358	30.0	29.8	29.6	29.6	29.6	29.7	+28	50.0	50.2	50.3	50.4	50.4	50.5
2.4	β Cassiopeiæ		358	19.4	19.1	18.9	18.9	19.0	19.2	+58	53.5	53.6	53.8	54.0	54.1	54.2
2.9	γ Pegasi		357	17.1	16.9	16.8	16.7	16.7	16.8	+14	55.6	55.7	55.8	55.9	55.9	55.9
2.9	β Hydri §		354	08.9	08.2	07.7	07.7	08.1	08.8	−77	30.5	30.6	30.7	30.8	31.0	31.0
2.4	Ankaa	2	353	59.7	59.4	59.3	59.2	59.3	59.4	−42	33.1	33.1	33.2	33.3	33.4	33.5
2.5	Schedar	3	350	31.9	31.6	31.4	31.3	31.3	31.5	+56	16.8	17.0	17.1	17.3	17.4	17.5
2.2	Diphda	4	349	40.8	40.6	40.4	40.4	40.4	40.5	−18	14.2	14.2	14.2	14.2	14.3	14.3
Var.*	γ Cassiopeiæ		346	31.5	31.1	30.9	30.8	30.8	30.9	+60	27.8	27.9	28.1	28.2	28.4	28.5
2.4	β Andromedæ		343	12.9	12.7	12.5	12.4	12.4	12.4	+35	22.5	22.6	22.7	22.8	22.9	22.9
2.8	δ Cassiopeiæ		339	18.5	18.1	17.8	17.6	17.6	17.7	+59	59.5	59.6	59.8	60.0	60.1	60.2
0.6	Achernar	5	335	59.9	59.6	59.3	59.2	59.2	59.4	−57	27.9	27.9	27.9	28.1	28.2	28.3
2.1	Polaris		331	76.3	65.5	57.2	52.4	52.2	56.8	+89	02.6	02.6	02.8	03.0	03.1	03.3
2.7	β Arietis		331	58.8	58.6	58.4	58.2	58.2	58.2	+20	35.0	35.1	35.1	35.2	35.2	35.3
3.0	α Hydri		330	40.2	39.8	39.5	39.4	39.4	39.6	−61	47.3	47.2	47.3	47.4	47.6	47.7
2.2	γ Andromedæ		329	44.3	44.0	43.8	43.6	43.5	43.6	+42	06.4	06.5	06.6	06.7	06.8	06.9
2.2	Hamal	6	328	51.6	51.4	51.2	51.0	51.0	51.0	+23	14.7	14.8	14.8	14.9	15.0	15.0
3.1	β Trianguli		328	18.3	18.0	17.8	17.6	17.6	17.6	+34	46.1	46.2	46.3	46.4	46.5	46.5
3.1	Acamar	7	315	52.5	52.2	52.0	51.8	51.7	51.7	−40	29.0	29.0	29.0	29.1	29.2	29.3
2.8	Menkar	8	315	02.2	02.0	01.7	01.6	01.5	01.5	+ 3	54.7	54.8	54.8	54.8	54.8	54.8
Var.†	β Persei		313	42.9	42.6	42.3	42.1	42.0	41.9	+40	46.7	46.7	46.8	46.9	47.0	47.1
1.9	Mirfak	9	309	45.1	44.7	44.4	44.1	44.0	43.9	+49	41.8	41.8	41.9	42.0	42.1	42.2
3.0	η Tauri		303	49.2	48.9	48.7	48.5	48.3	48.3	+23	57.8	57.9	57.9	58.0	58.0	58.0
2.9	ζ Persei		302	11.9	11.6	11.4	11.1	11.0	10.9	+31	44.9	44.9	45.0	45.0	45.1	45.1
3.0	ε Persei		301	19.1	18.8	18.5	18.2	18.1	18.0	+39	52.6	52.7	52.7	52.8	52.9	52.9
3.2	γ Eridani		301	02.1	01.9	01.6	01.5	01.3	01.3	−13	38.1	38.0	38.0	38.0	38.1	38.2
1.1	Aldebaran	10	291	41.2	41.0	40.8	40.5	40.4	40.3	+16	25.2	25.2	25.2	25.2	25.2	25.2
2.9	ι Aurigæ §		286	30.6	30.3	30.1	29.8	29.6	29.5	+33	05.7	05.7	05.7	05.8	05.8	05.8
2.9	β Eridani		283	36.6	36.4	36.2	36.0	35.8	35.7	− 5	08.5	08.5	08.4	08.4	08.5	08.6
0.3	Rigel	11	281	55.5	55.3	55.1	54.9	54.7	54.6	− 8	15.1	15.0	14.9	15.0	15.0	15.1
0.2	Capella	12	281	41.3	41.0	40.7	40.4	40.1	39.9	+45	57.2	57.2	57.2	57.2	57.3	57.3
1.7	Bellatrix	13	279	20.5	20.3	20.1	19.8	19.7	19.5	+ 6	18.7	18.7	18.8	18.8	18.7	18.7
1.8	Elnath	14	279	09.8	09.5	09.3	09.0	08.8	08.7	+28	34.3	34.3	34.3	34.3	34.3	34.3
3.0	β Leporis		278	26.3	26.1	25.9	25.7	25.5	25.4	−20	47.5	47.4	47.4	47.4	47.5	47.6
2.5	δ Orionis		277	35.6	35.4	35.2	35.0	34.8	34.6	− 0	19.8	19.7	19.7	19.7	19.7	19.8
2.7	α Leporis		277	19.9	19.7	19.5	19.3	19.1	19.0	−17	51.1	51.0	50.9	50.9	51.0	51.2
2.9	ι Orionis		276	42.7	42.5	42.3	42.1	41.9	41.7	− 5	56.2	56.1	56.1	56.1	56.1	56.2
1.8	Alnilam	15	276	32.3	32.1	31.8	31.6	31.4	31.3	− 1	13.7	13.6	13.6	13.6	13.6	13.7
3.0	ζ Tauri		276	17.1	16.9	16.6	16.4	16.2	16.0	+21	07.0	07.1	07.1	07.1	07.1	07.1
2.8	α Columbæ		275	30.7	30.5	30.3	30.0	29.8	29.7	−34	05.6	05.5	05.5	05.5	05.6	05.8
1.9	ζ Orionis		275	23.9	23.7	23.5	23.3	23.1	22.9	− 1	57.8	57.7	57.7	57.7	57.8	57.8
2.2	κ Orionis		273	36.8	36.6	36.4	36.2	36.0	35.9	− 9	40.9	40.8	40.8	40.8	40.9	41.0
Var.‡	Betelgeuse	16	271	50.2	50.0	49.8	49.6	49.4	49.2	+ 7	24.1	24.2	24.2	24.2	24.1	24.1
2.1	β Aurigæ		270	58.3	58.1	57.8	57.4	57.1	56.9	+44	56.7	56.7	56.7	56.7	56.7	56.8
2.7	θ Aurigæ		270	51.8	51.6	51.3	51.0	50.8	50.6	+37	12.7	12.7	12.7	12.7	12.7	12.7
2.0	β Canis Majoris		264	50.4	50.2	50.0	49.8	49.5	49.4	−17	55.7	55.6	55.6	55.6	55.7	55.8
−0.9	Canopus	17	264	16.6	16.5	16.2	15.9	15.6	15.4	−52	40.0	39.9	39.8	39.8	39.9	40.1
1.9	γ Geminorum		261	14.7	14.5	14.3	14.0	13.8	13.6	+16	26.5	26.5	26.5	26.5	26.5	26.4
−1.6	Sirius	18	259	13.7	13.5	13.3	13.1	12.9	12.7	−16	38.9	38.8	38.8	38.8	38.9	39.0
2.8	τ Puppis		257	48.7	48.5	48.3	48.0	47.7	47.5	−50	33.4	33.2	33.1	33.1	33.2	33.4
1.6	Adhara	19	255	48.2	48.1	47.9	47.7	47.4	47.2	−28	54.3	54.2	54.2	54.2	54.3	54.4
3.1	ο Canis Majoris		254	43.9	43.8	43.6	43.4	43.1	43.0	−23	45.7	45.6	45.6	45.6	45.7	45.8
2.0	δ Canis Majoris		253	22.7	22.6	22.4	22.1	21.9	21.7	−26	19.0	18.9	18.8	18.8	18.9	19.0
2.7	π Puppis		251	07.8	07.6	07.4	07.2	06.9	06.7	−37	00.7	00.5	00.5	00.5	00.5	00.7
2.4	η Canis Majoris		249	26.4	26.3	26.1	25.8	25.6	25.4	−29	12.6	12.5	12.4	12.4	12.5	12.6
3.1	β Canis Minoris		248	50.6	50.5	50.3	50.1	49.8	49.6	+ 8	23.2	23.2	23.2	23.2	23.1	23.0
3.3	σ Puppis		248	04.0	03.9	03.7	03.4	03.2	02.9	−43	12.3	12.2	12.1	12.1	12.1	12.3
1.6	α Geminorum		247	05.5	05.4	05.2	04.9	04.6	04.4	+31	59.6	59.6	59.5	59.5	59.4	59.4

*Irregular variable; 1950 Mag. 2.5. †2.3–3.5. ‡0.1–1.2. §Not suitable for use with H. O. 214.

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Mag.	Name and No.		SHA	Jan.	Feb.	Mar.	Apr.	May	June	Declination	Jan.	Feb.	Mar.	Apr.	May	June
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
0.5	Procyon	20	245	46.8	46.8	46.9	47.0	47.1	47.1	+ 5	20.8	20.7	20.7	20.7	20.7	20.8
1.2	Pollux	21	244	22.7	22.7	22.7	22.9	23.0	23.0	+28	08.5	08.5	08.5	08.5	08.5	08.5
2.3	ζ Puppis		239	30.5	30.5	30.6	30.8	30.9	31.0	−39	52.2	52.3	52.4	52.5	52.5	52.4
2.9	ρ Puppis		238	36.3	36.3	36.4	36.5	36.7	36.7	−24	10.1	10.2	10.3	10.3	10.3	10.2
1.9	γ Velorum		237	58.2	58.2	58.3	58.5	58.7	58.9	−47	11.8	12.0	12.1	12.2	12.1	12.1
1.7	Avior	22	234	36.1	36.1	36.3	36.6	36.9	37.1	−59	21.4	21.6	21.7	21.8	21.8	21.7
2.0	δ Velorum		229	08.3	08.3	08.4	08.7	08.9	09.1	−54	32.1	32.3	32.4	32.5	32.5	32.4
3.1	ι Ursæ Majoris		225	59.1	59.0	59.1	59.2	59.4	59.5	+48	13.5	13.6	13.7	13.7	13.8	13.7
2.2	Suhail	23	223	25.5	25.4	25.5	25.7	25.8	26.0	−43	14.5	14.7	14.8	14.9	14.9	14.8
1.8	Miaplacidus	24	221	48.9	48.8	49.0	49.4	49.8	50.2	−69	31.3	31.5	31.7	31.8	31.8	31.8
2.2	ι Carinæ		221	01.9	01.9	02.0	02.2	02.5	02.7	−59	04.6	04.8	04.9	05.0	05.1	05.0
2.6	κ Velorum		219	49.6	49.5	49.6	49.8	50.0	50.2	−54	48.5	48.7	48.8	48.9	49.0	48.9
2.2	Alphard	25	218	40.3	40.2	40.2	40.3	40.4	40.5	− 8	27.3	27.4	27.5	27.5	27.5	27.4
3.0	N Velorum		217	32.6	32.5	32.6	32.7	33.0	33.2	−56	49.5	49.7	49.9	50.0	50.0	50.0
3.1	ε Leonis		214	11.6	11.5	11.5	11.5	11.7	11.7	+23	59.3	59.3	59.4	59.4	59.4	59.4
1.3	Regulus	26	208	31.4	31.3	31.3	31.3	31.4	31.5	+12	11.7	11.7	11.7	11.7	11.7	11.7
2.3	γ Leonis		205	38.7	38.5	38.5	38.6	38.7	38.7	+20	04.6	04.6	04.6	04.7	04.7	04.7
3.0	θ Carinæ §		199	40.4	40.2	40.1	40.3	40.6	40.8	−64	08.7	08.9	09.1	09.3	09.4	09.4
2.8	μ Velorum		198	48.4	48.3	48.2	48.3	48.4	48.6	−49	10.2	10.4	10.5	10.7	10.7	10.7
2.4	β Ursæ Majoris		195	13.9	13.7	13.6	13.7	13.9	14.1	+56	37.8	37.8	37.9	38.1	38.1	38.1
2.0	Dubhe	27	194	46.4	46.1	46.1	46.2	46.4	46.6	+62	00.0	00.1	00.2	00.3	00.4	00.4
3.2	ψ Ursæ Majoris		193	13.9	13.7	13.6	13.7	13.8	14.0	+44	44.9	45.0	45.0	45.1	45.2	45.2
2.6	δ Leonis		192	05.3	05.2	05.1	05.1	05.2	05.3	+20	46.7	46.6	46.6	46.7	46.7	46.8
2.2	Denebola	28	183	19.6	19.4	19.3	19.3	19.4	19.5	+14	49.9	49.8	49.8	49.8	49.9	49.9
2.5	γ Ursæ Majoris		182	08.9	08.6	08.4	08.5	08.6	08.8	+53	57.0	57.0	57.1	57.2	57.3	57.4
2.9	δ Centauri		178	31.0	30.7	30.6	30.6	30.6	30.8	−50	27.5	27.7	27.9	28.0	28.1	28.2
2.8	Gienah	29	176	38.9	38.7	38.6	38.5	38.6	38.6	−17	16.9	17.1	17.1	17.2	17.2	17.2
1.1	Acrux	30	173	60.1	59.8	59.6	59.5	59.6	59.8	−62	50.2	50.3	50.5	50.7	50.8	50.9
1.6	Gacrux	31	172	51.5	51.2	51.0	51.0	51.1	51.2	−56	50.9	51.0	51.2	51.4	51.5	51.5
2.8	β Corvi		172	01.0	00.8	00.6	00.6	00.6	00.7	−23	08.3	08.4	08.5	08.6	08.6	08.6
2.9	α Muscæ		171	24.4	23.9	23.6	23.6	23.7	24.0	−68	52.4	52.6	52.8	52.9	53.1	53.2
2.4	γ Centauri		170	16.0	15.7	15.6	15.5	15.5	15.7	−48	42.0	42.2	42.3	42.5	42.6	42.6
2.9	γ Virginis		170	10.5	10.3	10.2	10.1	10.2	10.2	− 1	11.7	11.8	11.8	11.8	11.8	11.8
1.5	β Crucis		168	45.4	45.0	44.8	44.7	44.8	44.9	−59	25.8	25.9	26.1	26.3	26.4	26.5
1.7	Alioth	32	166	60.0	59.7	59.5	59.4	59.5	59.7	+56	12.4	12.5	12.5	12.7	12.8	12.9
2.9	α Canum Venat.		166	32.2	31.9	31.7	31.7	31.7	31.8	+38	33.9	33.9	34.0	34.1	34.2	34.2
3.0	ε Virginis		165	02.2	01.9	01.8	01.7	01.7	01.8	+11	12.4	12.4	12.3	12.4	12.4	12.5
2.9	ι Centauri		160	30.6	30.3	30.1	30.0	30.0	30.1	−36	27.9	28.0	28.1	28.2	28.3	28.3
2.2	ζ Ursæ Majoris		159	29.1	28.8	28.5	28.5	28.5	28.7	+55	09.8	09.8	09.8	10.0	10.1	10.2
1.2	Spica	33	159	19.1	18.8	18.7	18.6	18.6	18.6	−10	55.1	55.2	55.3	55.3	55.3	55.3
2.6	ε Centauri		155	46.4	46.1	45.8	45.7	45.6	45.7	−53	13.6	13.7	13.8	14.0	14.1	14.2
1.9	Alkaid	34	153	34.4	34.1	33.9	33.7	33.8	33.9	+49	32.4	32.4	32.4	32.6	32.7	32.8
2.8	η Bootis		151	53.1	52.9	52.7	52.6	52.5	52.6	+18	37.7	37.6	37.6	37.6	37.7	37.8
3.1	ζ Centauri		151	50.9	50.6	50.3	50.2	50.1	50.2	−47	03.4	03.5	03.6	03.8	03.9	03.9
0.9	Hadar	35	149	52.6	52.2	51.8	51.6	51.6	51.7	−60	08.7	08.8	08.9	09.1	09.2	09.3
2.3	Menkent	36	149	01.2	00.9	00.7	00.6	00.5	00.5	−36	08.4	08.5	08.6	08.7	08.8	08.8
0.2	Arcturus	37	146	37.1	36.8	36.6	36.5	36.5	36.5	+19	25.3	25.2	25.2	25.2	25.3	25.4
3.0	γ Bootis		142	27.1	26.8	26.6	26.4	26.4	26.4	+38	30.4	30.3	30.4	30.4	30.6	30.7
2.6	η Centauri		141	52.2	51.9	51.6	51.5	51.4	51.4	−41	57.1	57.2	57.3	57.4	57.5	57.6
0.1	Rigil Kent.	38	140	54.1	53.7	53.3	53.1	53.0	53.0	−60	38.5	38.6	38.7	38.8	39.0	39.1
2.9	α Lupi		140	18.0	17.7	17.4	17.2	17.1	17.1	−47	11.2	11.3	11.4	11.5	11.6	11.7
2.6	ε Bootis		139	15.9	15.6	15.4	15.3	15.2	15.2	+27	15.9	15.9	15.9	15.9	16.0	16.1
2.9	Zubenelgenubi	39	137	55.8	55.5	55.3	55.2	55.1	55.1	−15	51.0	51.1	51.1	51.2	51.2	51.2
2.2	Kochab	40	137	17.9	17.2	16.7	16.3	16.3	16.6	+74	20.4	20.4	20.4	20.5	20.7	20.8
2.8	β Lupi		136	08.3	08.0	07.7	07.5	07.4	07.4	−42	56.7	56.8	56.9	57.0	57.1	57.2
2.7	β Libræ		131	22.8	22.6	22.3	22.2	22.1	22.0	− 9	12.8	12.9	12.9	12.9	12.9	12.9
3.1	γ Trianguli Aust.		131	22.7	22.2	21.7	21.3	21.0	21.0	−68	30.4	30.4	30.5	30.6	30.8	30.9

§Not suitable for use with H. O. 214.

Mag.	Name and No.		SHA							Declination						
				July	Aug.	Sept.	Oct.	Nov.	Dec.		July	Aug.	Sept.	Oct.	Nov.	Dec.
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
0.5	Procyon	20	245	47.1	46.9	46.8	46.5	46.3	46.1	+ 5	20.8	20.8	20.8	20.8	20.7	20.7
1.2	Pollux	21	244	23.0	22.8	22.6	22.4	22.1	21.9	+28	08.5	08.5	08.4	08.4	08.3	08.3
2.3	ζ Puppis		239	31.1	31.0	30.8	30.6	30.3	30.0	−39	52.3	52.1	52.0	52.0	52.1	52.2
2.9	ρ Puppis		238	36.7	36.6	36.5	36.3	36.0	35.8	−24	10.1	10.0	09.9	09.9	10.0	10.1
1.9	γ Velorum		237	58.9	58.8	58.6	58.4	58.1	57.8	−47	11.9	11.8	11.7	11.6	11.7	11.8
1.7	Avior	22	234	37.2	37.1	36.9	36.6	36.2	35.9	−59	21.6	21.4	21.3	21.3	21.3	21.5
2.0	δ Velorum		229	09.2	09.2	09.0	08.7	08.4	08.0	−54	32.3	32.2	32.0	32.0	32.0	32.2
3.1	ι Ursæ Majoris		225	59.6	59.5	59.3	59.0	58.7	58.3	+48	13.6	13.5	13.4	13.3	13.2	13.2
2.2	Suhail	23	223	26.0	26.0	25.9	25.7	25.4	25.1	−43	14.7	14.6	14.5	14.4	14.5	14.6
1.8	Miaplacidus	24	221	50.5	50.5	50.3	49.9	49.4	48.9	−69	31.7	31.5	31.4	31.3	31.3	31.4
2.2	ι Carinæ		221	02.9	02.9	02.7	02.4	02.1	01.7	−59	04.9	04.8	04.6	04.6	04.6	04.7
2.6	κ Velorum		219	50.4	50.4	50.2	50.0	49.6	49.3	−54	48.8	48.7	48.5	48.5	48.5	48.6
2.2	Alphard	25	218	40.5	40.5	40.4	40.2	40.0	39.7	− 8	27.4	27.3	27.3	27.3	27.4	27.5
3.0	N Velorum		217	33.4	33.4	33.3	33.0	32.6	32.3	−56	49.9	49.7	49.6	49.5	49.5	49.6
3.1	ε Leonis		214	11.8	11.7	11.6	11.4	11.2	10.9	+23	59.4	59.4	59.3	59.3	59.2	59.1
1.3	Regulus	26	208	31.5	31.5	31.4	31.3	31.0	30.8	+12	11.8	11.7	11.7	11.7	11.6	11.5
2.3	γ Leonis		205	38.8	38.8	38.7	38.5	38.3	38.1	+20	04.7	04.7	04.6	04.5	04.4	04.3
3.0	θ Carinæ §		199	41.1	41.2	41.2	41.0	40.6	40.1	−64	09.3	09.2	09.0	08.9	08.9	08.9
2.8	μ Velorum		198	48.7	48.8	48.8	48.6	48.3	48.0	−49	10.7	10.6	10.4	10.3	10.3	10.4
2.4	β Ursæ Majoris		195	14.2	14.3	14.3	14.1	13.8	13.4	+56	38.1	38.0	37.8	37.7	37.5	37.4
2.0	Dubhe	27	194	46.9	47.0	46.9	46.7	46.4	46.0	+61	60.3	60.2	60.0	59.9	59.7	59.6
3.2	ψ Ursæ Majoris		193	14.1	14.1	14.1	13.9	13.7	13.4	+44	45.2	45.1	45.0	44.9	44.7	44.6
2.6	δ Leonis		192	05.3	05.4	05.3	05.2	05.0	04.8	+20	46.8	46.8	46.7	46.6	46.5	46.4
2.2	Denebola	28	183	19.5	19.6	19.6	19.5	19.3	19.1	+14	49.9	49.9	49.9	49.8	49.7	49.6
2.5	γ Ursæ Majoris		182	09.0	09.1	09.1	09.0	08.8	08.5	+53	57.4	57.3	57.1	57.0	56.8	56.7
2.9	δ Centauri		178	30.9	31.1	31.1	31.0	30.8	30.5	−50	28.1	28.0	27.9	27.8	27.8	27.8
2.8	Gienah	29	176	38.7	38.8	38.8	38.7	38.6	38.3	−17	17.2	17.1	17.1	17.1	17.1	17.2
1.1	Acrux	30	173	60.1	60.3	60.4	60.3	60.1	59.6	−62	50.9	50.8	50.7	50.6	50.5	50.5
1.6	Gacrux	31	172	51.4	51.6	51.7	51.6	51.4	51.0	−56	51.5	51.5	51.4	51.2	51.2	51.2
2.8	β Corvi		172	00.8	00.8	00.9	00.8	00.7	00.4	−23	08.6	08.5	08.5	08.4	08.4	08.5
2.9	α Muscæ		171	24.3	24.6	24.8	24.7	24.4	23.9	−68	53.2	53.1	53.0	52.8	52.7	52.7
2.4	γ Centauri		170	15.8	15.9	16.0	16.0	15.8	15.5	−48	42.6	42.5	42.4	42.3	42.3	42.3
2.9	γ Virginis		170	10.3	10.4	10.4	10.4	10.2	10.0	− 1	11.8	11.7	11.7	11.8	11.8	11.9
1.5	β Crucis		168	45.1	45.3	45.5	45.4	45.2	44.8	−59	26.5	26.4	26.3	26.2	26.1	26.1
1.7	Alioth	32	166	59.9	60.1	60.2	60.2	60.1	59.8	+56	12.9	12.8	12.7	12.5	12.3	12.2
2.9	α Canum Venat.		166	31.9	32.1	32.1	32.1	32.0	31.7	+38	34.3	34.2	34.1	34.0	33.8	33.7
3.0	ε Virginis		165	01.9	01.9	02.0	02.0	01.8	01.6	+11	12.5	12.5	12.5	12.4	12.3	12.2
2.9	ι Centauri		160	30.2	30.3	30.4	30.3	30.2	30.0	−36	28.3	28.3	28.2	28.1	28.1	28.1
2.2	ζ Ursæ Majoris		159	28.9	29.1	29.2	29.3	29.2	28.9	+55	10.2	10.2	10.1	09.9	09.7	09.6
1.2	Spica	33	159	18.7	18.7	18.8	18.8	18.7	18.5	−10	55.3	55.3	55.2	55.2	55.3	55.3
2.6	ε Centauri		155	45.8	46.0	46.2	46.2	46.0	45.7	−53	14.2	14.2	14.1	14.0	13.9	13.8
1.9	Alkaid	34	153	34.0	34.2	34.4	34.4	34.3	34.1	+49	32.8	32.8	32.7	32.6	32.4	32.2
2.8	η Bootis		151	52.7	52.8	52.8	52.9	52.8	52.6	+18	37.8	37.8	37.8	37.7	37.6	37.5
3.1	ζ Centauri		151	50.3	50.5	50.6	50.6	50.5	50.2	−47	04.0	03.9	03.8	03.7	03.7	03.6
0.9	Hadar	35	149	51.8	52.1	52.3	52.3	52.2	51.8	−60	09.4	09.4	09.3	09.1	09.0	09.0
2.3	Menkent	36	149	00.6	00.7	00.9	00.9	00.8	00.6	−36	08.8	08.8	08.7	08.7	08.6	08.6
0.2	Arcturus	37	146	36.6	36.7	36.8	36.8	36.8	36.6	+19	25.4	25.5	25.4	25.3	25.2	25.1
3.0	γ Bootis		142	26.6	26.7	26.8	26.9	26.9	26.7	+38	30.8	30.8	30.7	30.6	30.4	30.3
2.6	η Centauri		141	51.4	51.6	51.7	51.8	51.7	51.5	−41	57.6	57.6	57.5	57.4	57.4	57.3
0.1	Rigil Kent.	38	140	53.2	53.5	53.7	53.8	53.7	53.4	−60	39.1	39.1	39.1	38.9	38.8	38.7
2.9	α Lupi		140	17.2	17.4	17.5	17.6	17.5	17.3	−47	11.7	11.7	11.7	11.6	11.5	11.4
2.6	ε Bootis		139	15.3	15.4	15.5	15.6	15.6	15.4	+27	16.2	16.2	16.2	16.1	16.0	15.8
2.9	Zubenelgenubi	39	137	55.1	55.2	55.3	55.3	55.3	55.1	−15	51.2	51.1	51.1	51.1	51.1	51.1
2.2	Kochab	40	137	17.1	17.7	18.3	18.7	18.8	18.6	+74	20.9	20.9	20.8	20.7	20.5	20.3
2.8	β Lupi		136	07.4	07.6	07.7	07.8	07.7	07.5	−42	57.2	57.2	57.1	57.1	57.0	56.9
2.7	β Libræ		131	22.1	22.2	22.3	22.3	22.3	22.2	− 9	12.9	12.9	12.8	12.8	12.9	12.9
3.1	γ Trianguli Aust.		131	21.2	21.5	21.9	22.1	22.0	21.7	−68	31.0	31.0	31.0	30.8	30.7	30.6

§Not suitable for use with H. O. 214.

Mag.	Name and No.		SHA	Jan.	Feb.	Mar.	Apr.	May	June	Declination	Jan.	Feb.	Mar.	Apr.	May	June
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
3.1	γ Ursæ Minoris §		129	48.5	48.0	47.5	47.1	47.0	47.2	+71	59.6	59.6	59.6	59.7	59.9	60.0
3.0	γ Lupi §		126	60.0	59.7	59.4	59.1	59.0	58.9	−41	00.6	00.7	00.7	00.8	00.9	01.0
2.3	Alphecca	41	126	49.5	49.3	49.0	48.9	48.8	48.7	+26	52.0	51.9	51.9	51.9	52.1	52.2
2.8	α Serpentis		124	30.7	30.5	30.2	30.1	29.9	29.9	+ 6	34.1	34.0	34.0	34.0	34.1	34.1
3.0	β Trianguli Aust.		122	15.4	14.9	14.5	14.1	13.8	13.7	−63	17.2	17.2	17.3	17.4	17.5	17.6
2.5	δ Scorpii		120	36.7	36.5	36.2	36.0	35.9	35.8	−22	29.5	29.5	29.6	29.6	29.6	29.6
2.8	β Scorpii		119	19.5	19.2	19.0	18.8	18.6	18.6	−19	40.8	40.9	40.9	40.9	40.9	41.0
3.0	δ Ophiuchi		117	01.8	01.6	01.3	01.1	01.0	00.9	− 3	34.7	34.7	34.8	34.8	34.7	34.7
2.9	η Draconis		114	10.1	09.8	09.4	09.1	08.9	08.9	+61	36.8	36.7	36.7	36.8	37.0	37.1
1.2	Antares	42	113	22.2	21.9	21.7	21.4	21.3	21.2	−26	19.8	19.9	19.9	20.0	20.0	20.0
2.8	β Herculis		112	57.1	56.8	56.6	56.4	56.3	56.2	+21	35.2	35.1	35.0	35.1	35.2	35.3
2.9	τ Scorpii		111	45.7	45.5	45.2	45.0	44.8	44.7	−28	07.3	07.3	07.4	07.4	07.4	07.4
2.7	ζ Ophiuchi		111	21.5	21.2	21.0	20.8	20.7	20.6	−10	28.6	28.6	28.6	28.7	28.6	28.6
3.0	ζ Herculis		110	07.4	07.2	06.9	06.7	06.6	06.5	+31	40.9	40.8	40.8	40.8	41.0	41.1
1.9	Atria	43	109	05.2	04.7	04.1	03.6	03.2	03.0	−68	56.6	56.6	56.6	56.7	56.8	56.9
2.4	ε Scorpii		108	13.3	13.0	12.8	12.5	12.3	12.2	−34	12.6	12.6	12.7	12.7	12.8	12.8
3.1	ζ Aræ		106	19.3	18.9	18.5	18.2	17.9	17.7	−55	55.1	55.0	55.1	55.1	55.2	55.3
2.6	Sabik	44	103	04.8	04.6	04.4	04.1	04.0	03.8	−15	40.2	40.3	40.3	40.3	40.3	40.3
Var.*	α Herculis		101	52.5	52.3	52.1	51.9	51.7	51.6	+14	26.3	26.2	26.2	26.2	26.3	26.4
2.8	β Aræ		99	39.3	39.0	38.6	38.2	37.9	37.7	−55	29.3	29.2	29.2	29.3	29.3	29.4
2.8	υ Scorpii		98	06.6	06.3	06.0	05.8	05.5	05.4	−37	15.7	15.7	15.7	15.7	15.7	15.8
3.0	α Aræ		97	57.0	56.7	56.4	56.0	55.8	55.6	−49	50.5	50.5	50.4	50.5	50.5	50.6
3.0	β Draconis		97	39.8	39.6	39.3	39.0	38.8	38.7	+52	19.8	19.7	19.7	19.7	19.9	20.0
1.7	Shaula	45	97	23.8	23.6	23.3	23.0	22.8	22.6	−37	04.3	04.3	04.3	04.4	04.4	04.4
2.1	Rasalhague	46	96	48.8	48.6	48.4	48.2	48.0	47.9	+12	35.4	35.3	35.2	35.3	35.3	35.4
2.0	θ Scorpii		96	31.0	30.7	30.4	30.1	29.9	29.7	−42	58.2	58.2	58.2	58.2	58.3	58.3
2.5	κ Scorpii		95	11.6	11.3	11.0	10.7	10.5	10.3	−39	00.5	00.5	00.5	00.5	00.5	00.6
2.9	β Ophiuchi		94	42.8	42.6	42.4	42.2	42.0	41.9	+ 4	34.9	34.9	34.8	34.9	34.9	35.0
2.4	Eltanin	47	91	07.7	07.5	07.2	06.9	06.6	06.5	+51	29.4	29.2	29.2	29.2	29.3	29.5
3.1	γ Sagittarii		89	18.2	18.0	17.8	17.5	17.3	17.1	−30	25.7	25.7	25.7	25.7	25.7	25.7
2.8	δ Sagittarii		85	30.3	30.1	29.8	29.6	29.3	29.1	−29	51.1	51.1	51.1	51.1	51.0	51.0
2.0	Kaus Australis	48	84	44.3	44.1	43.8	43.5	43.3	43.1	−34	24.6	24.6	24.6	24.6	24.6	24.6
2.9	λ Sagittarii		83	44.0	43.8	43.6	43.3	43.1	42.9	−25	27.1	27.1	27.1	27.0	27.0	27.0
0.1	Vega	49	81	10.1	09.9	09.7	09.4	09.2	09.0	+38	44.1	44.0	44.0	44.0	44.1	44.2
2.1	Nunki	50	76	54.8	54.6	54.4	54.1	53.9	53.7	−26	21.5	21.5	21.5	21.4	21.4	21.4
2.7	ζ Sagittarii		75	05.7	05.6	05.3	05.1	04.8	04.6	−29	57.1	57.0	57.0	57.0	56.9	56.9
3.0	ζ Aquilæ		74	11.4	11.3	11.1	10.8	10.6	10.5	+13	47.4	47.3	47.3	47.3	47.4	47.5
3.0	π Sagittarii		73	15.5	15.4	15.2	14.9	14.7	14.5	−21	06.1	06.1	06.1	06.1	06.0	06.0
3.2	β Cygni		67	47.8	47.7	47.5	47.3	47.1	46.9	+27	51.5	51.4	51.3	51.3	51.4	51.5
3.0	δ Cygni		64	07.8	07.7	07.5	07.2	06.9	06.7	+45	00.8	00.7	00.6	00.6	00.7	00.8
2.8	γ Aquilæ		63	59.8	59.6	59.5	59.3	59.0	58.8	+10	29.7	29.7	29.6	29.7	29.7	29.8
0.9	Altair	51	62	52.8	52.7	52.5	52.3	52.0	51.8	+ 8	44.5	44.4	44.4	44.4	44.5	44.6
2.3	γ Cygni		54	52.2	52.1	52.0	51.7	51.4	51.2	+40	06.3	06.2	06.1	06.0	06.1	06.2
2.1	Peacock	52	54	31.0	30.9	30.6	30.2	29.8	29.5	−56	53.4	53.2	53.1	53.0	53.0	53.0
3.2	α Indi		51	26.1	25.9	25.7	25.4	25.1	24.8	−47	27.5	27.4	27.3	27.2	27.2	27.2
1.3	Deneb	53	50	02.9	02.9	02.7	02.5	02.2	01.9	+45	06.7	06.6	06.5	06.4	06.5	06.6
2.6	ε Cygni		48	55.6	55.6	55.4	55.2	54.9	54.7	+33	47.6	47.5	47.4	47.4	47.4	47.6
2.6	α Cephei		40	38.8	38.8	38.7	38.3	37.9	37.6	+62	23.3	23.1	23.0	22.9	22.9	23.0
3.1	β Aquarii		37	43.8	43.7	43.6	43.4	43.2	43.0	− 5	46.8	46.8	46.8	46.7	46.7	46.6
2.5	Enif	54	34	31.9	31.9	31.8	31.6	31.4	31.2	+ 9	39.5	39.5	39.4	39.4	39.5	39.6
3.0	δ Capricorni		33	53.3	53.3	53.1	53.0	52.7	52.5	−16	20.6	20.6	20.5	20.4	20.4	20.3
2.2	Al Na' ir	55	28	40.8	40.8	40.7	40.5	40.2	39.8	−47	11.5	11.4	11.3	11.2	11.0	11.0
2.9	α Tucanæ		26	10.5	10.6	10.4	10.2	09.8	09.4	−60	29.9	29.7	29.6	29.4	29.3	29.2
2.2	β Gruis		20	01.9	01.9	01.9	01.7	01.4	01.1	−47	08.0	07.9	07.8	07.6	07.5	07.4
1.3	Fomalhaut	56	16	14.1	14.1	14.0	13.9	13.7	13.4	−29	52.4	52.4	52.3	52.2	52.0	51.9
2.6	β Pegasi		14	37.7	37.7	37.7	37.6	37.3	37.1	+27	49.8	49.7	49.6	49.6	49.6	49.7
2.6	Markab	57	14	23.8	23.8	23.7	23.6	23.4	23.2	+14	57.2	57.1	57.1	57.1	57.1	57.2
3.4	γ Cephei §		5	40.1	40.5	40.7	40.4	39.7	38.9	+77	22.6	22.5	22.3	22.2	22.1	22.1

*3.0—3.7. §Not suitable for use with H. O. 214.

Mag.	Name and No.		SHA	July	Aug.	Sept.	Oct.	Nov.	Dec.	Declination	July	Aug.	Sept.	Oct.	Nov.	Dec.
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
3.1	γ Ursæ Minoris §		129	47.6	48.1	48.6	49.0	49.2	49.1	+71	60.1	60.2	60.1	60.0	59.8	59.6
3.0	γ Lupi §		126	59.0	59.1	59.3	59.4	59.3	59.2	−41	01.0	01.0	01.0	00.9	00.8	00.8
2.3	Alphecca	41	126	48.8	48.9	49.1	49.2	49.2	49.1	+26	52.3	52.3	52.3	52.2	52.1	51.9
2.8	α Serpentis		124	29.9	30.0	30.1	30.2	30.2	30.1	+ 6	34.2	34.2	34.2	34.2	34.1	34.0
3.0	β Trianguli Aust.		122	13.8	14.1	14.3	14.6	14.6	14.4	−63	17.7	17.7	17.7	17.6	17.5	17.4
2.5	δ Scorpii		120	35.8	35.9	36.0	36.1	36.1	36.0	−22	29.6	29.6	29.6	29.6	29.6	29.6
2.8	β Scorpii		119	18.6	18.7	18.8	18.9	18.9	18.7	−19	40.9	40.9	40.9	40.9	40.9	40.9
3.0	δ Ophiuchi		117	00.9	01.0	01.1	01.2	01.2	01.1	− 3	34.6	34.6	34.6	34.6	34.6	34.7
2.9	η Draconis		114	09.1	09.3	09.7	10.0	10.2	10.1	+61	37.3	37.3	37.3	37.2	37.1	36.9
1.2	Antares	42	113	21.2	21.2	21.4	21.5	21.5	21.4	−26	20.0	20.0	20.0	20.0	19.9	19.9
2.8	β Herculis		112	56.2	56.3	56.5	56.6	56.6	56.6	+21	35.4	35.5	35.5	35.4	35.3	35.2
2.9	τ Scorpii		111	44.7	44.8	44.9	45.0	45.0	44.9	−28	07.5	07.5	07.4	07.4	07.4	07.4
2.7	ζ Ophiuchi		111	20.6	20.6	20.7	20.8	20.9	20.8	−10	28.6	28.6	28.5	28.5	28.5	28.6
3.0	ζ Herculis		110	06.5	06.7	06.8	07.0	07.0	07.0	+31	41.2	41.3	41.3	41.2	41.1	41.0
1.9	Atria	43	109	03.0	03.3	03.6	03.9	04.1	03.9	−68	57.0	57.1	57.1	57.0	56.9	56.8
2.4	ε Scorpii		108	12.2	12.3	12.4	12.5	12.6	12.5	−34	12.8	12.8	12.8	12.8	12.8	12.7
3.1	ζ Aræ		106	17.7	17.8	18.0	18.3	18.3	18.2	−55	55.4	55.4	55.5	55.4	55.3	55.2
2.6	Sabik	44	103	03.8	03.9	04.0	04.1	04.1	04.1	−15	40.2	40.2	40.2	40.2	40.2	40.2
Var.*	α Herculis		101	51.6	51.7	51.8	51.9	52.0	51.9	+14	26.5	26.6	26.6	26.6	26.5	26.4
2.8	β Aræ		99	37.7	37.8	38.0	38.2	38.3	38.2	−55	29.5	29.6	29.6	29.6	29.5	29.4
2.8	υ Scorpii		98	05.3	05.4	05.5	05.7	05.7	05.7	−37	15.8	15.8	15.8	15.8	15.8	15.7
3.0	α Aræ		97	55.5	55.6	55.8	56.0	56.1	56.0	−49	50.7	50.7	50.8	50.7	50.7	50.6
3.0	β Draconis		97	38.7	38.9	39.1	39.4	39.6	39.6	+52	20.2	20.3	20.3	20.3	20.2	20.0
1.7	Shaula	45	97	22.6	22.6	22.8	22.9	23.0	22.9	−37	04.5	04.5	04.5	04.5	04.4	04.4
2.1	Rasalhague	46	96	47.9	47.9	48.0	48.2	48.2	48.2	+12	35.5	35.6	35.6	35.6	35.6	35.5
2.0	θ Scorpii		96	29.6	29.7	29.8	30.0	30.1	30.0	−42	58.4	58.4	58.4	58.4	58.4	58.3
2.5	κ Scorpii		95	10.3	10.3	10.5	10.6	10.7	10.6	−39	00.6	00.7	00.7	00.7	00.6	00.6
2.9	β Ophiuchi		94	41.8	41.9	42.0	42.1	42.2	42.2	+ 4	35.1	35.1	35.2	35.2	35.1	35.0
2.4	Eltanin	47	91	06.5	06.7	06.9	07.2	07.4	07.4	+51	29.7	29.8	29.9	29.8	29.7	29.6
3.1	γ Sagittarii		89	17.0	17.1	17.2	17.3	17.4	17.4	−30	25.7	25.7	25.7	25.7	25.7	25.7
2.8	δ Sagittarii		85	29.1	29.1	29.2	29.3	29.4	29.4	−29	51.1	51.1	51.1	51.1	51.1	51.0
2.0	Kaus Australis	48	84	43.0	43.0	43.1	43.3	43.4	43.4	−34	24.6	24.6	24.6	24.6	24.6	24.6
2.9	λ Sagittarii		83	42.8	42.8	42.9	43.1	43.2	43.2	−25	27.0	27.0	27.0	27.0	27.0	27.0
0.1	Vega	49	81	09.0	09.0	09.2	09.4	09.6	09.6	+38	44.4	44.5	44.6	44.6	44.5	44.4
2.1	Nunki	50	76	53.6	53.6	53.7	53.8	53.9	53.9	−26	21.4	21.4	21.4	21.4	21.4	21.4
2.7	ζ Sagittarii		75	04.5	04.5	04.6	04.7	04.8	04.8	−29	56.9	57.0	57.0	57.0	57.0	57.0
3.0	ζ Aquilæ		74	10.4	10.4	10.5	10.6	10.7	10.7	+13	47.6	47.7	47.7	47.7	47.7	47.6
3.0	π Sagittarii		73	14.4	14.3	14.4	14.6	14.7	14.7	−21	06.0	06.0	06.0	06.0	06.0	06.0
3.2	β Cygni		67	46.8	46.8	46.9	47.0	47.2	47.2	+27	51.7	51.8	51.9	51.9	51.9	51.8
3.0	δ Cygni		64	06.6	06.6	06.7	07.0	07.2	07.3	+45	01.0	01.1	01.3	01.3	01.3	01.2
2.8	γ Aquilæ		63	58.7	58.7	58.8	58.9	59.0	59.0	+10	29.9	30.0	30.1	30.1	30.1	30.0
0.9	Altair	51	62	51.7	51.7	51.8	51.9	52.0	52.0	+ 8	44.7	44.8	44.8	44.8	44.8	44.8
2.3	γ Cygni		54	51.1	51.0	51.1	51.3	51.5	51.6	+40	06.4	06.6	06.7	06.8	06.7	06.7
2.1	Peacock	52	54	29.2	29.1	29.2	29.4	29.7	29.8	−56	53.1	53.2	53.2	53.3	53.3	53.2
3.2	α Indi		51	24.6	24.5	24.5	24.7	24.9	25.0	−47	27.2	27.3	27.3	27.4	27.4	27.4
1.3	Deneb	53	50	01.8	01.7	01.8	02.0	02.2	02.3	+45	06.8	07.0	07.1	07.2	07.2	07.1
2.6	ε Cygni		48	54.5	54.5	54.5	54.7	54.8	54.9	+33	47.7	47.9	48.0	48.0	48.0	48.0
2.6	α Cephei		40	37.3	37.2	37.3	37.6	37.9	38.2	+62	23.2	23.4	23.6	23.7	23.7	23.7
3.1	β Aquarii		37	42.8	42.7	42.7	42.7	42.8	42.9	− 5	46.5	46.4	46.4	46.4	46.4	46.5
2.5	Enif	54	34	31.0	30.9	30.8	30.9	31.0	31.1	+ 9	39.7	39.8	39.9	39.9	39.9	39.9
3.0	δ Capricorni		33	52.3	52.1	52.1	52.2	52.3	52.4	−16	20.2	20.2	20.2	20.2	20.2	20.2
2.2	Al Na' ir	55	28	39.6	39.4	39.3	39.4	39.6	39.8	−47	11.0	11.0	11.1	11.2	11.3	11.3
2.9	α Tucanæ		26	09.0	08.8	08.7	08.9	09.1	09.4	−60	29.2	29.3	29.4	29.6	29.6	29.6
2.2	β Gruis		20	00.8	00.6	00.5	00.6	00.7	00.9	−47	07.4	07.4	07.5	07.6	07.7	07.7
1.3	Fomalhaut	56	16	13.2	13.0	12.9	12.9	13.0	13.1	−29	51.9	51.9	51.9	52.0	52.0	52.1
2.6	β Pegasi		14	36.8	36.7	36.6	36.6	36.7	36.8	+27	49.8	50.0	50.1	50.2	50.2	50.2
2.6	Markab	57	14	22.9	22.8	22.7	22.7	22.8	22.9	+14	57.4	57.5	57.6	57.6	57.6	57.6
3.4	γ Cephei §		5	38.2	37.6	37.4	37.5	37.9	38.5	+77	22.2	22.4	22.5	22.7	22.9	23.0

*3.0–3.7.

§Not suitable for use with H. O. 214.

°	h m	°	h m	°	h m	°	h m	°	h m	°	h m
0	0 00	60	4 00	120	8 00	180	12 00	240	16 00	300	20 00
1	0 04	61	4 04	121	8 04	181	12 04	241	16 04	301	20 04
2	0 08	62	4 08	122	8 08	182	12 08	242	16 08	302	20 08
3	0 12	63	4 12	123	8 12	183	12 12	243	16 12	303	20 12
4	0 16	64	4 16	124	8 16	184	12 16	244	16 16	304	20 16
5	0 20	65	4 20	125	8 20	185	12 20	245	16 20	305	20 20
6	0 24	66	4 24	126	8 24	186	12 24	246	16 24	306	20 24
7	0 28	67	4 28	127	8 28	187	12 28	247	16 28	307	20 28
8	0 32	68	4 32	128	8 32	188	12 32	248	16 32	308	20 32
9	0 36	69	4 36	129	8 36	189	12 36	249	16 36	309	20 36
10	0 40	70	4 40	130	8 40	190	12 40	250	16 40	310	20 40
11	0 44	71	4 44	131	8 44	191	12 44	251	16 44	311	20 44
12	0 48	72	4 48	132	8 48	192	12 48	252	16 48	312	20 48
13	0 52	73	4 52	133	8 52	193	12 52	253	16 52	313	20 52
14	0 56	74	4 56	134	8 56	194	12 56	254	16 56	314	20 56
15	1 00	75	5 00	135	9 00	195	13 00	255	17 00	315	21 00
16	1 04	76	5 04	136	9 04	196	13 04	256	17 04	316	21 04
17	1 08	77	5 08	137	9 08	197	13 08	257	17 08	317	21 08
18	1 12	78	5 12	138	9 12	198	13 12	258	17 12	318	21 12
19	1 16	79	5 16	139	9 16	199	13 16	259	17 16	319	21 16
20	1 20	80	5 20	140	9 20	200	13 20	260	17 20	320	21 20
21	1 24	81	5 24	141	9 24	201	13 24	261	17 24	321	21 24
22	1 28	82	5 28	142	9 28	202	13 28	262	17 28	322	21 28
23	1 32	83	5 32	143	9 32	203	13 32	263	17 32	323	21 32
24	1 36	84	5 36	144	9 36	204	13 36	264	17 36	324	21 36
25	1 40	85	5 40	145	9 40	205	13 40	265	17 40	325	21 40
26	1 44	86	5 44	146	9 44	206	13 44	266	17 44	326	21 44
27	1 48	87	5 48	147	9 48	207	13 48	267	17 48	327	21 48
28	1 52	88	5 52	148	9 52	208	13 52	268	17 52	328	21 52
29	1 56	89	5 56	149	9 56	209	13 56	269	17 56	329	21 56
30	2 00	90	6 00	150	10 00	210	14 00	270	18 00	330	22 00
31	2 04	91	6 04	151	10 04	211	14 04	271	18 04	331	22 04
32	2 08	92	6 08	152	10 08	212	14 08	272	18 08	332	22 08
33	2 12	93	6 12	153	10 12	213	14 12	273	18 12	333	22 12
34	2 16	94	6 16	154	10 16	214	14 16	274	18 16	334	22 16
35	2 20	95	6 20	155	10 20	215	14 20	275	18 20	335	22 20
36	2 24	96	6 24	156	10 24	216	14 24	276	18 24	336	22 24
37	2 28	97	6 28	157	10 28	217	14 28	277	18 28	337	22 28
38	2 32	98	6 32	158	10 32	218	14 32	278	18 32	338	22 32
39	2 36	99	6 36	159	10 36	219	14 36	279	18 36	339	22 36
40	2 40	100	6 40	160	10 40	220	14 40	280	18 40	340	22 40
41	2 44	101	6 44	161	10 44	221	14 44	281	18 44	341	22 44
42	2 48	102	6 48	162	10 48	222	14 48	282	18 48	342	22 48
43	2 52	103	6 52	163	10 52	223	14 52	283	18 52	343	22 52
44	2 56	104	6 56	164	10 56	224	14 56	284	18 56	344	22 56
45	3 00	105	7 00	165	11 00	225	15 00	285	19 00	345	23 00
46	3 04	106	7 04	166	11 04	226	15 04	286	19 04	346	23 04
47	3 08	107	7 08	167	11 08	227	15 08	287	19 08	347	23 08
48	3 12	108	7 12	168	11 12	228	15 12	288	19 12	348	23 12
49	3 16	109	7 16	169	11 16	229	15 16	289	19 16	349	23 16
50	3 20	110	7 20	170	11 20	230	15 20	290	19 20	350	23 20
51	3 24	111	7 24	171	11 24	231	15 24	291	19 24	351	23 24
52	3 28	112	7 28	172	11 28	232	15 28	292	19 28	352	23 28
53	3 32	113	7 32	173	11 32	233	15 32	293	19 32	353	23 32
54	3 36	114	7 36	174	11 36	234	15 36	294	19 36	354	23 36
55	3 40	115	7 40	175	11 40	235	15 40	295	19 40	355	23 40
56	3 44	116	7 44	176	11 44	236	15 44	296	19 44	356	23 44
57	3 48	117	7 48	177	11 48	237	15 48	297	19 48	357	23 48
58	3 52	118	7 52	178	11 52	238	15 52	298	19 52	358	23 52
59	3 56	119	7 56	179	11 56	239	15 56	299	19 56	359	23 56
60	4 00	120	8 00	180	12 00	240	16 00	300	20 00	360	24 00

′	m s
0	0 00
1	0 04
2	0 08
3	0 12
4	0 16
5	0 20
6	0 24
7	0 28
8	0 32
9	0 36
10	0 40
11	0 44
12	0 48
13	0 52
14	0 56
15	1 00
16	1 04
17	1 08
18	1 12
19	1 16
20	1 20
21	1 24
22	1 28
23	1 32
24	1 36
25	1 40
26	1 44
27	1 48
28	1 52
29	1 56
30	2 00
31	2 04
32	2 08
33	2 12
34	2 16
35	2 20
36	2 24
37	2 28
38	2 32
39	2 36
40	2 40
41	2 44
42	2 48
43	2 52
44	2 56
45	3 00
46	3 04
47	3 08
48	3 12
49	3 16
50	3 20
51	3 24
52	3 28
53	3 32
54	3 36
55	3 40
56	3 44
57	3 48
58	3 52
59	3 56
60	4 00

″	s
0	0.00
1	0.07
2	0.13
3	0.20
4	0.27
5	0.33
6	0.40
7	0.47
8	0.53
9	0.60
10	0.67
11	0.73
12	0.80
13	0.87
14	0.93
15	1.00
16	1.07
17	1.13
18	1.20
19	1.27
20	1.33
21	1.40
22	1.47
23	1.53
24	1.60
25	1.67
26	1.73
27	1.80
28	1.87
29	1.93
30	2.00
31	2.07
32	2.13
33	2.20
34	2.27
35	2.33
36	2.40
37	2.47
38	2.53
39	2.60
40	2.67
41	2.73
42	2.80
43	2.87
44	2.93
45	3.00
46	3.07
47	3.13
48	3.20
49	3.27
50	3.33
51	3.40
52	3.47
53	3.53
54	3.60
55	3.67
56	3.73
57	3.80
58	3.87
59	3.93
60	4.00

[When the sign is plus, Polaris is east of north; when the sign is minus, it is west of north]

LHAT \ Lat.	+10°	+15°	+20°	+25°	+30°	+35°	+40°	+45°	+50°	+55°	+60°	+65°	+70°
°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.7	+0.8	+0.9	+1.1	+1.3
10	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.9
20	+0.1	+0.1	+0.1	+0.1	+0.1	+0.2	+0.2	+0.2	+0.2	+0.2	+0.3	+0.3	+0.4
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	−0.1	−0.1	−0.1	−0.1	−0.1	−0.1
40	−0.2	−0.2	−0.2	−0.2	−0.2	−0.2	−0.3	−0.3	−0.3	−0.4	−0.4	−0.5	−0.6
50	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.9	1.1
60	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.5
70	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.0	1.1	1.3	1.6	1.9
80	−0.8	−0.8	−0.8	−0.8	−0.9	−0.9	−1.0	−1.1	−1.2	−1.3	−1.5	−1.8	−2.3
90	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.3	1.5	1.7	2.0	2.5
100	0.9	0.9	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.6	1.8	2.2	2.7
110	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.5	1.6	1.9	2.2	2.8
120	−1.0	−1.0	−1.0	−1.0	−1.1	−1.2	−1.2	−1.3	−1.5	−1.7	−1.9	−2.2	−2.8
130	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.6	1.8	2.2	2.7
140	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.4	1.5	1.7	2.1	2.5
150	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.4	1.6	1.9	2.3
160	−0.7	−0.7	−0.7	−0.8	−0.8	−0.9	−0.9	−1.0	−1.1	−1.2	−1.4	−1.6	−2.0
170	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.1	1.3	1.6
180	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.2
190	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.7	0.8
200	−0.1	−0.1	−0.1	−0.1	−0.1	−0.2	−0.2	−0.2	−0.2	−0.2	−0.2	−0.3	−0.4
210	0.0	0.0	0.0	0.0	0.0	0.0	0.0	+0.1	+0.1	+0.1	+0.1	+0.1	+0.1
220	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.3	0.3	0.3	0.3	0.4	0.5	0.6
230	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	1.0
240	+0.5	+0.5	+0.5	+0.6	+0.6	+0.6	+0.7	+0.7	+0.8	+0.9	+1.0	+1.2	+1.4
250	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.0	1.1	1.3	1.5	1.8
260	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.5	1.7	2.1
270	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.3	1.5	1.7	2.0	2.4
280	+0.9	+0.9	+1.0	+1.0	+1.0	+1.1	+1.2	+1.3	+1.4	+1.6	+1.8	+2.1	+2.6
290	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.5	1.6	1.9	2.2	2.7
300	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.5	1.7	1.9	2.2	2.8
310	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.6	1.9	2.2	2.7
320	+0.9	+0.9	+0.9	+1.0	+1.0	+1.1	+1.2	+1.3	+1.4	+1.5	+1.8	+2.1	+2.6
330	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.3	1.4	1.6	1.9	2.4
340	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.4	1.7	2.1
350	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.2	1.4	1.8
360	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.7	+0.8	+0.9	+1.1	+1.3

FIRST CORRECTION TO CORRECTED ALTITUDE

LHAT	Corr.	LHAT	Corr.	LHAT	Corr.	LHAT	Corr.	LHAT	Corr.	LHAT	Corr.
°	′	°	′	°	′	°	′	°	′	°	′
0	−50.4	60	−48.1	120	+ 2.7	180	+50.6	240	+48.4	300	− 1.8
1	50.8	61	47.5	121	3.7	181	51.0	241	47.8	301	2.8
2	51.3	62	47.0	122	4.7	182	51.4	242	47.3	302	3.8
3	51.7	63	46.4	123	5.7	183	51.8	243	46.7	303	4.8
4	52.1	64	45.8	124	6.7	184	52.2	244	46.1	304	5.7
5	−52.5	65	−45.2	125	+ 7.7	185	+52.6	245	+45.6	305	− 6.7
6	52.9	66	44.6	126	8.6	186	53.0	246	45.0	306	7.7
7	53.2	67	44.0	127	9.6	187	53.4	247	44.3	307	8.7
8	53.6	68	43.3	128	10.6	188	53.7	248	43.7	308	9.7
9	53.9	69	42.6	129	11.6	189	54.0	249	43.1	309	10.7
10	−54.2	70	−42.0	130	+12.5	190	+54.3	250	+42.4	310	−11.6
11	54.5	71	41.3	131	13.5	191	54.6	251	41.7	311	12.6
12	54.8	72	40.6	132	14.5	192	54.9	252	41.1	312	13.6
13	55.1	73	39.9	133	15.4	193	55.2	253	40.4	313	14.6
14	55.3	74	39.2	134	16.4	194	55.4	254	39.7	314	15.5
15	−55.6	75	−38.4	135	+17.3	195	+55.6	255	+39.0	315	−16.5
16	55.8	76	37.7	136	18.3	196	55.8	256	38.2	316	17.4
17	56.0	77	36.9	137	19.2	197	56.0	257	37.5	317	18.4
18	56.2	78	36.2	138	20.2	198	56.2	258	36.7	318	19.3
19	56.3	79	35.4	139	21.1	199	56.4	259	36.0	319	20.2
20	−56.5	80	−34.6	140	+22.0	200	+56.5	260	+35.2	320	−21.2
21	56.6	81	33.8	141	22.9	201	56.6	261	34.4	321	22.1
22	56.7	82	33.0	142	23.8	202	56.7	262	33.6	322	23.0
23	56.8	83	32.2	143	24.7	203	56.8	263	32.8	323	23.9
24	56.9	84	31.4	144	25.6	204	56.9	264	32.0	324	24.8
25	−56.9	85	−30.5	145	+26.5	205	+56.9	265	+31.2	325	−25.7
26	57.0	86	29.6	146	27.4	206	57.0	266	30.3	326	26.6
27	57.0	87	28.8	147	28.2	207	57.0	267	29.5	327	27.5
28	57.0	88	27.9	148	29.1	208	57.0	268	28.6	328	28.4
29	57.0	89	27.1	149	29.9	209	57.0	269	27.8	329	29.2
30	−57.0	90	−26.2	150	+30.8	210	+57.0	270	+26.9	330	−30.1
31	56.9	91	25.3	151	31.6	211	56.9	271	26.0	331	30.9
32	56.8	92	24.4	152	32.4	212	56.8	272	25.2	332	31.8
33	56.8	93	23.5	153	33.2	213	56.8	273	24.3	333	32.6
34	56.7	94	22.6	154	34.0	214	56.7	274	23.4	334	33.4
35	−56.5	95	−21.6	155	+34.8	215	+56.6	275	+22.4	335	−34.2
36	56.4	96	20.7	156	35.6	216	56.4	276	21.5	336	35.0
37	56.2	97	19.8	157	36.4	217	56.3	277	20.6	337	35.8
38	56.1	98	18.8	158	37.1	218	56.1	278	19.7	338	36.6
39	55.9	99	17.9	159	37.8	219	55.9	279	18.8	339	37.3
40	−55.7	100	−16.9	160	+38.6	220	+55.7	280	+17.8	340	−38.1
41	55.5	101	16.0	161	39.3	221	55.5	281	16.8	341	38.8
42	55.2	102	15.0	162	40.0	222	55.3	282	15.9	342	39.5
43	55.0	103	14.1	163	40.7	223	55.0	283	15.0	343	40.2
44	54.8	104	13.1	164	41.4	224	54.8	284	14.0	344	40.9
45	−54.4	105	−12.1	165	+42.1	225	+54.5	285	+13.0	345	−41.6
46	54.1	106	11.2	166	42.7	226	54.2	286	12.1	346	42.3
47	53.8	107	10.2	167	43.4	227	53.9	287	11.1	347	43.0
48	53.4	108	9.2	168	44.0	228	53.5	288	10.1	348	43.6
49	53.1	109	8.2	169	44.6	229	53.2	289	9.1	349	44.3
50	−52.7	110	− 7.2	170	+45.2	230	+52.8	290	+ 8.2	350	−44.9
51	52.3	111	6.2	171	45.8	231	52.4	291	7.2	351	45.5
52	51.9	112	5.2	172	46.4	232	52.0	292	6.2	352	46.1
53	51.5	113	4.2	173	47.0	233	51.6	293	5.2	353	46.7
54	51.0	114	3.2	174	47.5	234	51.2	294	4.2	354	47.2
55	−50.6	115	− 2.3	175	+48.1	235	+50.8	295	+ 3.2	355	−47.8
56	50.1	116	1.3	176	48.6	236	50.3	296	2.2	356	48.3
57	49.6	117	− 0.3	177	49.1	237	49.8	297	1.2	357	48.9
58	49.1	118	+ 0.7	178	49.6	238	49.4	298	+ 0.2	358	49.4
59	48.6	119	1.7	179	50.1	239	48.9	299	− 0.8	359	49.9
60	−48.1	120	+ 2.7	180	+50.6	240	+48.4	300	− 1.8	360	−50.4

SECOND CORRECTION TO CORRECTED ALTITUDE

LHAT \ Date	Jan. 1	Feb. 1	Mar. 1	Apr. 1	May 1	June 1	July 1	Aug. 1	Sept. 1	Oct. 1	Nov. 1	Dec. 1	Dec.32
°	′	′	′	′	′	′	′	′	′	′	′	′	′
0	+0.1	0.0	−0.1	−0.3	−0.4	−0.5	−0.4	−0.3	−0.2	0.0	+0.2	+0.4	+0.4
20	+0.1	+0.1	0.0	−0.2	−0.3	−0.4	−0.4	−0.4	−0.3	−0.1	+0.1	+0.3	+0.4
40	+0.1	+0.1	+0.1	0.0	−0.2	−0.3	−0.4	−0.4	−0.3	−0.2	0.0	+0.1	+0.3
60	0.0	+0.2	+0.2	+0.1	0.0	−0.2	−0.3	−0.4	−0.4	−0.3	−0.2	0.0	+0.2
80	0.0	+0.2	+0.2	+0.2	+0.1	0.0	−0.2	−0.3	−0.4	−0.4	−0.3	−0.1	0.0
100	0.0	+0.2	+0.3	+0.3	+0.3	+0.1	0.0	−0.2	−0.3	−0.4	−0.4	−0.3	−0.1
120	0.0	+0.1	+0.3	+0.4	+0.4	+0.3	+0.1	−0.1	−0.2	−0.3	−0.4	−0.4	−0.2
140	0.0	+0.1	+0.2	+0.4	+0.4	+0.4	+0.3	+0.1	−0.1	−0.3	−0.4	−0.4	−0.4
160	0.0	0.0	+0.2	+0.3	+0.4	+0.4	+0.4	+0.2	0.0	−0.2	−0.3	−0.4	−0.4
180	−0.1	0.0	+0.1	+0.3	+0.4	+0.5	+0.4	+0.3	+0.2	0.0	−0.2	−0.4	−0.4
200	−0.1	−0.1	0.0	+0.2	+0.3	+0.4	+0.4	+0.4	+0.3	+0.1	−0.1	−0.3	−0.4
220	−0.1	−0.1	−0.1	0.0	+0.2	+0.3	+0.4	+0.4	+0.3	+0.2	0.0	−0.1	−0.3
240	0.0	−0.2	−0.2	−0.1	0.0	+0.2	+0.3	+0.4	+0.4	+0.3	+0.2	0.0	−0.2
260	0.0	−0.2	−0.2	−0.2	−0.1	0.0	+0.2	+0.3	+0.4	+0.4	+0.3	+0.1	0.0
280	0.0	−0.2	−0.3	−0.3	−0.3	−0.1	0.0	+0.2	+0.3	+0.4	+0.4	+0.3	+0.1
300	0.0	−0.1	−0.3	−0.4	−0.4	−0.3	−0.1	+0.1	+0.2	+0.3	+0.4	+0.4	+0.2
320	0.0	−0.1	−0.2	−0.4	−0.4	−0.4	−0.3	−0.1	+0.1	+0.3	+0.4	+0.4	+0.4
340	0.0	0.0	−0.2	−0.3	−0.4	−0.4	−0.4	−0.2	0.0	+0.2	+0.3	+0.4	+0.4
360	+0.1	0.0	−0.1	−0.3	−0.4	−0.5	−0.4	−0.3	−0.2	0.0	+0.2	+0.4	+0.4

LATITUDE BY POLARIS, 1953

THIRD CORRECTION TO CORRECTED ALTITUDE

LHAT \ Altitude	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
°	′	′	′	′	′	′	′	′	′	′	′	′	′
0	−0.1	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	0.0	0.0	+0.1	+0.1	+0.2
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	−0.1	−0.1	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	+0.1	+0.1	+0.2	+0.2
80	−0.2	−0.2	−0.2	−0.2	−0.1	−0.1	0.0	0.0	+0.1	+0.1	+0.2	+0.4	+0.5
100	−0.4	−0.3	−0.3	−0.2	−0.2	−0.1	−0.1	0.0	+0.1	+0.2	+0.3	+0.5	+0.7
120	−0.4	−0.4	−0.3	−0.3	−0.2	−0.1	−0.1	0.0	+0.1	+0.2	+0.3	+0.6	+0.8
140	−0.3	−0.3	−0.3	−0.2	−0.2	−0.1	−0.1	0.0	+0.1	+0.2	+0.3	+0.5	+0.7
160	−0.2	−0.2	−0.2	−0.1	−0.1	−0.1	0.0	0.0	+0.1	+0.1	+0.2	+0.3	+0.5
180	−0.1	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	0.0	0.0	+0.1	+0.1	+0.2
200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240	−0.1	−0.1	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	+0.1	+0.1	+0.2	+0.2
260	−0.2	−0.2	−0.2	−0.2	−0.1	−0.1	0.0	0.0	+0.1	+0.1	+0.2	+0.4	+0.5
280	−0.4	−0.3	−0.3	−0.2	−0.2	−0.1	−0.1	0.0	+0.1	+0.2	+0.3	+0.5	+0.7
300	−0.4	−0.4	−0.3	−0.3	−0.2	−0.1	−0.1	0.0	+0.1	+0.2	+0.3	+0.6	+0.8
320	−0.3	−0.3	−0.3	−0.2	−0.2	−0.1	−0.1	0.0	+0.1	+0.2	+0.3	+0.5	+0.7
340	−0.2	−0.2	−0.2	−0.1	−0.1	−0.1	0.0	0.0	+0.1	+0.1	+0.2	+0.3	+0.5
360	−0.1	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	0.0	0.0	+0.1	+0.1	+0.2

918768°—52——18

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	0m								
	° ′	° ′	° ′		′		′		′
0	0 00.0	0 00.0	0 00.0	0	0.0	60	0.1	120	0.1
1	0 00.3	0 00.3	0 00.2	1	0.0	61	0.1	121	0.1
2	0 00.5	0 00.5	0 00.5	2	0.0	62	0.1	122	0.1
3	0 00.8	0 00.8	0 00.7	3	0.0	63	0.1	123	0.1
4	0 01.0	0 01.0	0 01.0	4	0.0	64	0.1	124	0.1
5	0 01.3	0 01.3	0 01.2	5	0.0	65	0.1	125	0.1
6	0 01.5	0 01.5	0 01.4	6	0.0	66	0.1	126	0.1
7	0 01.8	0 01.8	0 01.7	7	0.0	67	0.1	127	0.1
8	0 02.0	0 02.0	0 01.9	8	0.0	68	0.1	128	0.1
9	0 02.3	0 02.3	0 02.1	9	0.0	69	0.1	129	0.1
10	0 02.5	0 02.5	0 02.4	10	0.0	70	0.1	130	0.1
11	0 02.8	0 02.8	0 02.6	11	0.0	71	0.1	131	0.1
12	0 03.0	0 03.0	0 02.9	12	0.0	72	0.1	132	0.1
13	0 03.3	0 03.3	0 03.1	13	0.0	73	0.1	133	0.1
14	0 03.5	0 03.5	0 03.3	14	0.0	74	0.1	134	0.1
15	0 03.8	0 03.8	0 03.6	15	0.0	75	0.1	135	0.1
16	0 04.0	0 04.0	0 03.8	16	0.0	76	0.1	136	0.1
17	0 04.3	0 04.3	0 04.1	17	0.0	77	0.1	137	0.1
18	0 04.5	0 04.5	0 04.3	18	0.0	78	0.1	138	0.1
19	0 04.8	0 04.8	0 04.5	19	0.0	79	0.1	139	0.1
20	0 05.0	0 05.0	0 04.8	20	0.0	80	0.1	140	0.1
21	0 05.3	0 05.3	0 05.0	21	0.0	81	0.1	141	0.1
22	0 05.5	0 05.5	0 05.2	22	0.0	82	0.1	142	0.1
23	0 05.8	0 05.8	0 05.5	23	0.0	83	0.1	143	0.1
24	0 06.0	0 06.0	0 05.7	24	0.0	84	0.1	144	0.1
25	0 06.3	0 06.3	0 06.0	25	0.0	85	0.1	145	0.1
26	0 06.5	0 06.5	0 06.2	26	0.0	86	0.1	146	0.1
27	0 06.8	0 06.8	0 06.4	27	0.0	87	0.1	147	0.1
28	0 07.0	0 07.0	0 06.7	28	0.0	88	0.1	148	0.1
29	0 07.3	0 07.3	0 06.9	29	0.0	89	0.1	149	0.1
30	0 07.5	0 07.5	0 07.2	30	0.0	90	0.1	150	0.1
31	0 07.8	0 07.8	0 07.4	31	0.0	91	0.1	151	0.1
32	0 08.0	0 08.0	0 07.6	32	0.0	92	0.1	152	0.1
33	0 08.3	0 08.3	0 07.9	33	0.0	93	0.1	153	0.1
34	0 08.5	0 08.5	0 08.1	34	0.0	94	0.1	154	0.1
35	0 08.8	0 08.8	0 08.4	35	0.0	95	0.1	155	0.1
36	0 09.0	0 09.0	0 08.6	36	0.0	96	0.1	156	0.1
37	0 09.3	0 09.3	0 08.8	37	0.0	97	0.1	157	0.1
38	0 09.5	0 09.5	0 09.1	38	0.0	98	0.1	158	0.1
39	0 09.8	0 09.8	0 09.3	39	0.0	99	0.1	159	0.1
40	0 10.0	0 10.0	0 09.5	40	0.0	100	0.1	160	0.1
41	0 10.3	0 10.3	0 09.8	41	0.0	101	0.1	161	0.1
42	0 10.5	0 10.5	0 10.0	42	0.0	102	0.1	162	0.1
43	0 10.8	0 10.8	0 10.3	43	0.0	103	0.1	163	0.1
44	0 11.0	0 11.0	0 10.5	44	0.0	104	0.1	164	0.1
45	0 11.3	0 11.3	0 10.7	45	0.0	105	0.1	165	0.1
46	0 11.5	0 11.5	0 11.0	46	0.0	106	0.1	166	0.1
47	0 11.8	0 11.8	0 11.2	47	0.0	107	0.1	167	0.1
48	0 12.0	0 12.0	0 11.5	48	0.0	108	0.1	168	0.1
49	0 12.3	0 12.3	0 11.7	49	0.0	109	0.1	169	0.1
50	0 12.5	0 12.5	0 11.9	50	0.0	110	0.1	170	0.1
51	0 12.8	0 12.8	0 12.2	51	0.0	111	0.1	171	0.1
52	0 13.0	0 13.0	0 12.4	52	0.0	112	0.1	172	0.1
53	0 13.3	0 13.3	0 12.6	53	0.0	113	0.1	173	0.1
54	0 13.5	0 13.5	0 12.9	54	0.0	114	0.1	174	0.1
55	0 13.8	0 13.8	0 13.1	55	0.0	115	0.1	175	0.1
56	0 14.0	0 14.0	0 13.4	56	0.0	116	0.1	176	0.1
57	0 14.3	0 14.3	0 13.6	57	0.0	117	0.1	177	0.1
58	0 14.5	0 14.5	0 13.8	58	0.0	118	0.1	178	0.1
59	0 14.8	0 14.8	0 14.1	59	0.0	119	0.1	179	0.1
60	0 15.0	0 15.0	0 14.3	60	0.1	120	0.1	180	0.2

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	1m								
	° ′	° ′	° ′		′		′		′
0	0 15.0	0 15.0	0 14.3	0	0.0	60	0.2	120	0.3
1	0 15.3	0 15.3	0 14.6	1	0.0	61	0.2	121	0.3
2	0 15.5	0 15.5	0 14.8	2	0.0	62	0.2	122	0.3
3	0 15.8	0 15.8	0 15.0	3	0.0	63	0.2	123	0.3
4	0 16.0	0 16.0	0 15.3	4	0.0	64	0.2	124	0.3
5	0 16.3	0 16.3	0 15.5	5	0.0	65	0.2	125	0.3
6	0 16.5	0 16.5	0 15.7	6	0.0	66	0.2	126	0.3
7	0 16.8	0 16.8	0 16.0	7	0.0	67	0.2	127	0.3
8	0 17.0	0 17.0	0 16.2	8	0.0	68	0.2	128	0.3
9	0 17.3	0 17.3	0 16.5	9	0.0	69	0.2	129	0.3
10	0 17.5	0 17.5	0 16.7	10	0.0	70	0.2	130	0.3
11	0 17.8	0 17.8	0 16.9	11	0.0	71	0.2	131	0.3
12	0 18.0	0 18.0	0 17.2	12	0.0	72	0.2	132	0.3
13	0 18.3	0 18.3	0 17.4	13	0.0	73	0.2	133	0.3
14	0 18.5	0 18.6	0 17.7	14	0.0	74	0.2	134	0.3
15	0 18.8	0 18.8	0 17.9	15	0.0	75	0.2	135	0.3
16	0 19.0	0 19.1	0 18.1	16	0.0	76	0.2	136	0.3
17	0 19.3	0 19.3	0 18.4	17	0.0	77	0.2	137	0.3
18	0 19.5	0 19.6	0 18.6	18	0.0	78	0.2	138	0.3
19	0 19.8	0 19.8	0 18.9	19	0.0	79	0.2	139	0.3
20	0 20.0	0 20.1	0 19.1	20	0.1	80	0.2	140	0.4
21	0 20.3	0 20.3	0 19.3	21	0.1	81	0.2	141	0.4
22	0 20.5	0 20.6	0 19.6	22	0.1	82	0.2	142	0.4
23	0 20.8	0 20.8	0 19.8	23	0.1	83	0.2	143	0.4
24	0 21.0	0 21.1	0 20.0	24	0.1	84	0.2	144	0.4
25	0 21.3	0 21.3	0 20.3	25	0.1	85	0.2	145	0.4
26	0 21.5	0 21.6	0 20.5	26	0.1	86	0.2	146	0.4
27	0 21.8	0 21.8	0 20.8	27	0.1	87	0.2	147	0.4
28	0 22.0	0 22.1	0 21.0	28	0.1	88	0.2	148	0.4
29	0 22.3	0 22.3	0 21.2	29	0.1	89	0.2	149	0.4
30	0 22.5	0 22.6	0 21.5	30	0.1	90	0.2	150	0.4
31	0 22.8	0 22.8	0 21.7	31	0.1	91	0.2	151	0.4
32	0 23.0	0 23.1	0 22.0	32	0.1	92	0.2	152	0.4
33	0 23.3	0 23.3	0 22.2	33	0.1	93	0.2	153	0.4
34	0 23.5	0 23.6	0 22.4	34	0.1	94	0.2	154	0.4
35	0 23.8	0 23.8	0 22.7	35	0.1	95	0.2	155	0.4
36	0 24.0	0 24.1	0 22.9	36	0.1	96	0.2	156	0.4
37	0 24.3	0 24.3	0 23.1	37	0.1	97	0.2	157	0.4
38	0 24.5	0 24.6	0 23.4	38	0.1	98	0.2	158	0.4
39	0 24.8	0 24.8	0 23.6	39	0.1	99	0.2	159	0.4
40	0 25.0	0 25.1	0 23.9	40	0.1	100	0.3	160	0.4
41	0 25.3	0 25.3	0 24.1	41	0.1	101	0.3	161	0.4
42	0 25.5	0 25.6	0 24.3	42	0.1	102	0.3	162	0.4
43	0 25.8	0 25.8	0 24.6	43	0.1	103	0.3	163	0.4
44	0 26.0	0 26.1	0 24.8	44	0.1	104	0.3	164	0.4
45	0 26.3	0 26.3	0 25.1	45	0.1	105	0.3	165	0.4
46	0 26.5	0 26.6	0 25.3	46	0.1	106	0.3	166	0.4
47	0 26.8	0 26.8	0 25.5	47	0.1	107	0.3	167	0.4
48	0 27.0	0 27.1	0 25.8	48	0.1	108	0.3	168	0.4
49	0 27.3	0 27.3	0 26.0	49	0.1	109	0.3	169	0.4
50	0 27.5	0 27.6	0 26.2	50	0.1	110	0.3	170	0.4
51	0 27.8	0 27.8	0 26.5	51	0.1	111	0.3	171	0.4
52	0 28.0	0 28.1	0 26.7	52	0.1	112	0.3	172	0.4
53	0 28.3	0 28.3	0 27.0	53	0.1	113	0.3	173	0.4
54	0 28.5	0 28.6	0 27.2	54	0.1	114	0.3	174	0.4
55	0 28.8	0 28.8	0 27.4	55	0.1	115	0.3	175	0.4
56	0 29.0	0 29.1	0 27.7	56	0.1	116	0.3	176	0.4
57	0 29.3	0 29.3	0 27.9	57	0.1	117	0.3	177	0.4
58	0 29.5	0 29.6	0 28.2	58	0.1	118	0.3	178	0.4
59	0 29.8	0 29.8	0 28.4	59	0.1	119	0.3	179	0.4
60	0 30.0	0 30.1	0 28.6	60	0.2	120	0.3	180	0.5

2m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	0 30.0	0 30.1	0 28.6	0	0.0	60	0.3	120	0.5
1	0 30.3	0 30.3	0 28.9	1	0.0	61	0.3	121	0.5
2	0 30.5	0 30.6	0 29.1	2	0.0	62	0.3	122	0.5
3	0 30.8	0 30.8	0 29.3	3	0.0	63	0.3	123	0.5
4	0 31.0	0 31.1	0 29.6	4	0.0	64	0.3	124	0.5
5	0 31.3	0 31.3	0 29.8	5	0.0	65	0.3	125	0.5
6	0 31.5	0 31.6	0 30.1	6	0.0	66	0.3	126	0.5
7	0 31.8	0 31.8	0 30.3	7	0.0	67	0.3	127	0.5
8	0 32.0	0 32.1	0 30.5	8	0.0	68	0.3	128	0.5
9	0 32.3	0 32.3	0 30.8	9	0.0	69	0.3	129	0.5
10	0 32.5	0 32.6	0 31.0	10	0.0	70	0.3	130	0.5
11	0 32.8	0 32.8	0 31.3	11	0.0	71	0.3	131	0.5
12	0 33.0	0 33.1	0 31.5	12	0.1	72	0.3	132	0.6
13	0 33.3	0 33.3	0 31.7	13	0.1	73	0.3	133	0.6
14	0 33.5	0 33.6	0 32.0	14	0.1	74	0.3	134	0.6
15	0 33.8	0 33.8	0 32.2	15	0.1	75	0.3	135	0.6
16	0 34.0	0 34.1	0 32.5	16	0.1	76	0.3	136	0.6
17	0 34.3	0 34.3	0 32.7	17	0.1	77	0.3	137	0.6
18	0 34.5	0 34.6	0 32.9	18	0.1	78	0.3	138	0.6
19	0 34.8	0 34.8	0 33.2	19	0.1	79	0.3	139	0.6
20	0 35.0	0 35.1	0 33.4	20	0.1	80	0.3	140	0.6
21	0 35.3	0 35.3	0 33.6	21	0.1	81	0.3	141	0.6
22	0 35.5	0 35.6	0 33.9	22	0.1	82	0.3	142	0.6
23	0 35.8	0 35.8	0 34.1	23	0.1	83	0.3	143	0.6
24	0 36.0	0 36.1	0 34.4	24	0.1	84	0.4	144	0.6
25	0 36.3	0 36.3	0 34.6	25	0.1	85	0.4	145	0.6
26	0 36.5	0 36.6	0 34.8	26	0.1	86	0.4	146	0.6
27	0 36.8	0 36.9	0 35.1	27	0.1	87	0.4	147	0.6
28	0 37.0	0 37.1	0 35.3	28	0.1	88	0.4	148	0.6
29	0 37.3	0 37.4	0 35.6	29	0.1	89	0.4	149	0.6
30	0 37.5	0 37.6	0 35.8	30	0.1	90	0.4	150	0.6
31	0 37.8	0 37.9	0 36.0	31	0.1	91	0.4	151	0.6
32	0 38.0	0 38.1	0 36.3	32	0.1	92	0.4	152	0.6
33	0 38.3	0 38.4	0 36.5	33	0.1	93	0.4	153	0.6
34	0 38.5	0 38.6	0 36.7	34	0.1	94	0.4	154	0.6
35	0 38.8	0 38.9	0 37.0	35	0.1	95	0.4	155	0.6
36	0 39.0	0 39.1	0 37.2	36	0.2	96	0.4	156	0.7
37	0 39.3	0 39.4	0 37.5	37	0.2	97	0.4	157	0.7
38	0 39.5	0 39.6	0 37.7	38	0.2	98	0.4	158	0.7
39	0 39.8	0 39.9	0 37.9	39	0.2	99	0.4	159	0.7
40	0 40.0	0 40.1	0 38.2	40	0.2	100	0.4	160	0.7
41	0 40.3	0 40.4	0 38.4	41	0.2	101	0.4	161	0.7
42	0 40.5	0 40.6	0 38.7	42	0.2	102	0.4	162	0.7
43	0 40.8	0 40.9	0 38.9	43	0.2	103	0.4	163	0.7
44	0 41.0	0 41.1	0 39.1	44	0.2	104	0.4	164	0.7
45	0 41.3	0 41.4	0 39.4	45	0.2	105	0.4	165	0.7
46	0 41.5	0 41.6	0 39.6	46	0.2	106	0.4	166	0.7
47	0 41.8	0 41.9	0 39.8	47	0.2	107	0.4	167	0.7
48	0 42.0	0 42.1	0 40.1	48	0.2	108	0.5	168	0.7
49	0 42.3	0 42.4	0 40.3	49	0.2	109	0.5	169	0.7
50	0 42.5	0 42.6	0 40.6	50	0.2	110	0.5	170	0.7
51	0 42.8	0 42.9	0 40.8	51	0.2	111	0.5	171	0.7
52	0 43.0	0 43.1	0 41.0	52	0.2	112	0.5	172	0.7
53	0 43.3	0 43.4	0 41.3	53	0.2	113	0.5	173	0.7
54	0 43.5	0 43.6	0 41.5	54	0.2	114	0.5	174	0.7
55	0 43.8	0 43.9	0 41.8	55	0.2	115	0.5	175	0.7
56	0 44.0	0 44.1	0 42.0	56	0.2	116	0.5	176	0.7
57	0 44.3	0 44.4	0 42.2	57	0.2	117	0.5	177	0.7
58	0 44.5	0 44.6	0 42.5	58	0.2	118	0.5	178	0.7
59	0 44.8	0 44.9	0 42.7	59	0.2	119	0.5	179	0.7
60	0 45.0	0 45.1	0 43.0	60	0.3	120	0.5	180	0.8

3m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	0 45.0	0 45.1	0 43.0	0	0.0	60	0.4	120	0.7
1	0 45.3	0 45.4	0 43.2	1	0.0	61	0.4	121	0.7
2	0 45.5	0 45.6	0 43.4	2	0.0	62	0.4	122	0.7
3	0 45.8	0 45.9	0 43.7	3	0.0	63	0.4	123	0.7
4	0 46.0	0 46.1	0 43.9	4	0.0	64	0.4	124	0.7
5	0 46.3	0 46.4	0 44.1	5	0.0	65	0.4	125	0.7
6	0 46.5	0 46.6	0 44.4	6	0.0	66	0.4	126	0.7
7	0 46.8	0 46.9	0 44.6	7	0.0	67	0.4	127	0.7
8	0 47.0	0 47.1	0 44.9	8	0.0	68	0.4	128	0.7
9	0 47.3	0 47.4	0 45.1	9	0.1	69	0.4	129	0.8
10	0 47.5	0 47.6	0 45.3	10	0.1	70	0.4	130	0.8
11	0 47.8	0 47.9	0 45.6	11	0.1	71	0.4	131	0.8
12	0 48.0	0 48.1	0 45.8	12	0.1	72	0.4	132	0.8
13	0 48.3	0 48.4	0 46.1	13	0.1	73	0.4	133	0.8
14	0 48.5	0 48.6	0 46.3	14	0.1	74	0.4	134	0.8
15	0 48.8	0 48.9	0 46.5	15	0.1	75	0.4	135	0.8
16	0 49.0	0 49.1	0 46.8	16	0.1	76	0.4	136	0.8
17	0 49.3	0 49.4	0 47.0	17	0.1	77	0.4	137	0.8
18	0 49.5	0 49.6	0 47.2	18	0.1	78	0.5	138	0.8
19	0 49.8	0 49.9	0 47.5	19	0.1	79	0.5	139	0.8
20	0 50.0	0 50.1	0 47.7	20	0.1	80	0.5	140	0.8
21	0 50.3	0 50.4	0 48.0	21	0.1	81	0.5	141	0.8
22	0 50.5	0 50.6	0 48.2	22	0.1	82	0.5	142	0.8
23	0 50.8	0 50.9	0 48.4	23	0.1	83	0.5	143	0.8
24	0 51.0	0 51.1	0 48.7	24	0.1	84	0.5	144	0.8
25	0 51.3	0 51.4	0 48.9	25	0.1	85	0.5	145	0.8
26	0 51.5	0 51.6	0 49.2	26	0.2	86	0.5	146	0.9
27	0 51.8	0 51.9	0 49.4	27	0.2	87	0.5	147	0.9
28	0 52.0	0 52.1	0 49.6	28	0.2	88	0.5	148	0.9
29	0 52.3	0 52.4	0 49.9	29	0.2	89	0.5	149	0.9
30	0 52.5	0 52.6	0 50.1	30	0.2	90	0.5	150	0.9
31	0 52.8	0 52.9	0 50.3	31	0.2	91	0.5	151	0.9
32	0 53.0	0 53.1	0 50.6	32	0.2	92	0.5	152	0.9
33	0 53.3	0 53.4	0 50.8	33	0.2	93	0.5	153	0.9
34	0 53.5	0 53.6	0 51.1	34	0.2	94	0.5	154	0.9
35	0 53.8	0 53.9	0 51.3	35	0.2	95	0.6	155	0.9
36	0 54.0	0 54.1	0 51.5	36	0.2	96	0.6	156	0.9
37	0 54.3	0 54.4	0 51.8	37	0.2	97	0.6	157	0.9
38	0 54.5	0 54.6	0 52.0	38	0.2	98	0.6	158	0.9
39	0 54.8	0 54.9	0 52.3	39	0.2	99	0.6	159	0.9
40	0 55.0	0 55.2	0 52.5	40	0.2	100	0.6	160	0.9
41	0 55.3	0 55.4	0 52.7	41	0.2	101	0.6	161	0.9
42	0 55.5	0 55.7	0 53.0	42	0.2	102	0.6	162	0.9
43	0 55.8	0 55.9	0 53.2	43	0.3	103	0.6	163	1.0
44	0 56.0	0 56.2	0 53.4	44	0.3	104	0.6	164	1.0
45	0 56.3	0 56.4	0 53.7	45	0.3	105	0.6	165	1.0
46	0 56.5	0 56.7	0 53.9	46	0.3	106	0.6	166	1.0
47	0 56.8	0 56.9	0 54.2	47	0.3	107	0.6	167	1.0
48	0 57.0	0 57.2	0 54.4	48	0.3	108	0.6	168	1.0
49	0 57.3	0 57.4	0 54.6	49	0.3	109	0.6	169	1.0
50	0 57.5	0 57.7	0 54.9	50	0.3	110	0.6	170	1.0
51	0 57.8	0 57.9	0 55.1	51	0.3	111	0.6	171	1.0
52	0 58.0	0 58.2	0 55.4	52	0.3	112	0.7	172	1.0
53	0 58.3	0 58.4	0 55.6	53	0.3	113	0.7	173	1.0
54	0 58.5	0 58.7	0 55.8	54	0.3	114	0.7	174	1.0
55	0 58.8	0 58.9	0 56.1	55	0.3	115	0.7	175	1.0
56	0 59.0	0 59.2	0 56.3	56	0.3	116	0.7	176	1.0
57	0 59.3	0 59.4	0 56.6	57	0.3	117	0.7	177	1.0
58	0 59.5	0 59.7	0 56.8	58	0.3	118	0.7	178	1.0
59	0 59.8	0 59.9	0 57.0	59	0.3	119	0.7	179	1.0
60	1 00.0	1 00.2	0 57.3	60	0.4	120	0.7	180	1.1

4m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	1 00.0	1 00.2	0 57.3	0	0.0	60	0.5	120	0.9
1	1 00.3	1 00.4	0 57.5	1	0.0	61	0.5	121	0.9
2	1 00.5	1 00.7	0 57.7	2	0.0	62	0.5	122	0.9
3	1 00.8	1 00.9	0 58.0	3	0.0	63	0.5	123	0.9
4	1 01.0	1 01.2	0 58.2	4	0.0	64	0.5	124	0.9
5	1 01.3	1 01.4	0 58.5	5	0.0	65	0.5	125	0.9
6	1 01.5	1 01.7	0 58.7	6	0.0	66	0.5	126	0.9
7	1 01.8	1 01.9	0 58.9	7	0.1	67	0.5	127	1.0
8	1 02.0	1 02.2	0 59.2	8	0.1	68	0.5	128	1.0
9	1 02.3	1 02.4	0 59.4	9	0.1	69	0.5	129	1.0
10	1 02.5	1 02.7	0 59.7	10	0.1	70	0.5	130	1.0
11	1 02.8	1 02.9	0 59.9	11	0.1	71	0.5	131	1.0
12	1 03.0	1 03.2	1 00.1	12	0.1	72	0.5	132	1.0
13	1 03.3	1 03.4	1 00.4	13	0.1	73	0.5	133	1.0
14	1 03.5	1 03.7	1 00.6	14	0.1	74	0.6	134	1.0
15	1 03.8	1 03.9	1 00.8	15	0.1	75	0.6	135	1.0
16	1 04.0	1 04.2	1 01.1	16	0.1	76	0.6	136	1.0
17	1 04.3	1 04.4	1 01.3	17	0.1	77	0.6	137	1.0
18	1 04.5	1 04.7	1 01.6	18	0.1	78	0.6	138	1.0
19	1 04.8	1 04.9	1 01.8	19	0.1	79	0.6	139	1.0
20	1 05.0	1 05.2	1 02.0	20	0.2	80	0.6	140	1.1
21	1 05.3	1 05.4	1 02.3	21	0.2	81	0.6	141	1.1
22	1 05.5	1 05.7	1 02.5	22	0.2	82	0.6	142	1.1
23	1 05.8	1 05.9	1 02.8	23	0.2	83	0.6	143	1.1
24	1 06.0	1 06.2	1 03.0	24	0.2	84	0.6	144	1.1
25	1 06.3	1 06.4	1 03.2	25	0.2	85	0.6	145	1.1
26	1 06.5	1 06.7	1 03.5	26	0.2	86	0.6	146	1.1
27	1 06.8	1 06.9	1 03.7	27	0.2	87	0.7	147	1.1
28	1 07.0	1 07.2	1 03.9	28	0.2	88	0.7	148	1.1
29	1 07.3	1 07.4	1 04.2	29	0.2	89	0.7	149	1.1
30	1 07.5	1 07.7	1 04.4	30	0.2	90	0.7	150	1.1
31	1 07.8	1 07.9	1 04.7	31	0.2	91	0.7	151	1.1
32	1 08.0	1 08.2	1 04.9	32	0.2	92	0.7	152	1.1
33	1 08.3	1 08.4	1 05.1	33	0.2	93	0.7	153	1.1
34	1 08.5	1 08.7	1 05.4	34	0.3	94	0.7	154	1.2
35	1 08.8	1 08.9	1 05.6	35	0.3	95	0.7	155	1.2
36	1 09.0	1 09.2	1 05.9	36	0.3	96	0.7	156	1.2
37	1 09.3	1 09.4	1 06.1	37	0.3	97	0.7	157	1.2
38	1 09.5	1 09.7	1 06.3	38	0.3	98	0.7	158	1.2
39	1 09.8	1 09.9	1 06.6	39	0.3	99	0.7	159	1.2
40	1 10.0	1 10.2	1 06.8	40	0.3	100	0.8	160	1.2
41	1 10.3	1 10.4	1 07.0	41	0.3	101	0.8	161	1.2
42	1 10.5	1 10.7	1 07.3	42	0.3	102	0.8	162	1.2
43	1 10.8	1 10.9	1 07.5	43	0.3	103	0.8	163	1.2
44	1 11.0	1 11.2	1 07.8	44	0.3	104	0.8	164	1.2
45	1 11.3	1 11.4	1 08.0	45	0.3	105	0.8	165	1.2
46	1 11.5	1 11.7	1 08.2	46	0.3	106	0.8	166	1.2
47	1 11.8	1 11.9	1 08.5	47	0.4	107	0.8	167	1.3
48	1 12.0	1 12.2	1 08.7	48	0.4	108	0.8	168	1.3
49	1 12.3	1 12.4	1 09.0	49	0.4	109	0.8	169	1.3
50	1 12.5	1 12.7	1 09.2	50	0.4	110	0.8	170	1.3
51	1 12.8	1 12.9	1 09.4	51	0.4	111	0.8	171	1.3
52	1 13.0	1 13.2	1 09.7	52	0.4	112	0.8	172	1.3
53	1 13.3	1 13.5	1 09.9	53	0.4	113	0.8	173	1.3
54	1 13.5	1 13.7	1 10.2	54	0.4	114	0.9	174	1.3
55	1 13.8	1 14.0	1 10.4	55	0.4	115	0.9	175	1.3
56	1 14.0	1 14.2	1 10.6	56	0.4	116	0.9	176	1.3
57	1 14.3	1 14.5	1 10.9	57	0.4	117	0.9	177	1.3
58	1 14.5	1 14.7	1 11.1	58	0.4	118	0.9	178	1.3
59	1 14.8	1 15.0	1 11.3	59	0.4	119	0.9	179	1.3
60	1 15.0	1 15.2	1 11.6	60	0.5	120	0.9	180	1.4

5m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	1 15.0	1 15.2	1 11.6	0	0.0	60	0.6	120	1.1
1	1 15.3	1 15.5	1 11.8	1	0.0	61	0.6	121	1.1
2	1 15.5	1 15.7	1 12.1	2	0.0	62	0.6	122	1.1
3	1 15.8	1 16.0	1 12.3	3	0.0	63	0.6	123	1.1
4	1 16.0	1 16.2	1 12.5	4	0.0	64	0.6	124	1.1
5	1 16.3	1 16.5	1 12.8	5	0.0	65	0.6	125	1.1
6	1 16.5	1 16.7	1 13.0	6	0.1	66	0.6	126	1.2
7	1 16.8	1 17.0	1 13.3	7	0.1	67	0.6	127	1.2
8	1 17.0	1 17.2	1 13.5	8	0.1	68	0.6	128	1.2
9	1 17.3	1 17.5	1 13.7	9	0.1	69	0.6	129	1.2
10	1 17.5	1 17.7	1 14.0	10	0.1	70	0.6	130	1.2
11	1 17.8	1 18.0	1 14.2	11	0.1	71	0.7	131	1.2
12	1 18.0	1 18.2	1 14.4	12	0.1	72	0.7	132	1.2
13	1 18.3	1 18.5	1 14.7	13	0.1	73	0.7	133	1.2
14	1 18.5	1 18.7	1 14.9	14	0.1	74	0.7	134	1.2
15	1 18.8	1 19.0	1 15.2	15	0.1	75	0.7	135	1.2
16	1 19.0	1 19.2	1 15.4	16	0.1	76	0.7	136	1.2
17	1 19.3	1 19.5	1 15.6	17	0.2	77	0.7	137	1.3
18	1 19.5	1 19.7	1 15.9	18	0.2	78	0.7	138	1.3
19	1 19.8	1 20.0	1 16.1	19	0.2	79	0.7	139	1.3
20	1 20.0	1 20.2	1 16.4	20	0.2	80	0.7	140	1.3
21	1 20.3	1 20.5	1 16.6	21	0.2	81	0.7	141	1.3
22	1 20.5	1 20.7	1 16.8	22	0.2	82	0.8	142	1.3
23	1 20.8	1 21.0	1 17.1	23	0.2	83	0.8	143	1.3
24	1 21.0	1 21.2	1 17.3	24	0.2	84	0.8	144	1.3
25	1 21.3	1 21.5	1 17.5	25	0.2	85	0.8	145	1.3
26	1 21.5	1 21.7	1 17.8	26	0.2	86	0.8	146	1.3
27	1 21.8	1 22.0	1 18.0	27	0.2	87	0.8	147	1.3
28	1 22.0	1 22.2	1 18.3	28	0.3	88	0.8	148	1.4
29	1 22.3	1 22.5	1 18.5	29	0.3	89	0.8	149	1.4
30	1 22.5	1 22.7	1 18.7	30	0.3	90	0.8	150	1.4
31	1 22.8	1 23.0	1 19.0	31	0.3	91	0.8	151	1.4
32	1 23.0	1 23.2	1 19.2	32	0.3	92	0.8	152	1.4
33	1 23.3	1 23.5	1 19.5	33	0.3	93	0.9	153	1.4
34	1 23.5	1 23.7	1 19.7	34	0.3	94	0.9	154	1.4
35	1 23.8	1 24.0	1 19.9	35	0.3	95	0.9	155	1.4
36	1 24.0	1 24.2	1 20.2	36	0.3	96	0.9	156	1.4
37	1 24.3	1 24.5	1 20.4	37	0.3	97	0.9	157	1.4
38	1 24.5	1 24.7	1 20.7	38	0.3	98	0.9	158	1.4
39	1 24.8	1 25.0	1 20.9	39	0.4	99	0.9	159	1.5
40	1 25.0	1 25.2	1 21.1	40	0.4	100	0.9	160	1.5
41	1 25.3	1 25.5	1 21.4	41	0.4	101	0.9	161	1.5
42	1 25.5	1 25.7	1 21.6	42	0.4	102	0.9	162	1.5
43	1 25.8	1 26.0	1 21.8	43	0.4	103	0.9	163	1.5
44	1 26.0	1 26.2	1 22.1	44	0.4	104	1.0	164	1.5
45	1 26.3	1 26.5	1 22.3	45	0.4	105	1.0	165	1.5
46	1 26.5	1 26.7	1 22.6	46	0.4	106	1.0	166	1.5
47	1 26.8	1 27.0	1 22.8	47	0.4	107	1.0	167	1.5
48	1 27.0	1 27.2	1 23.0	48	0.4	108	1.0	168	1.5
49	1 27.3	1 27.5	1 23.3	49	0.4	109	1.0	169	1.5
50	1 27.5	1 27.7	1 23.5	50	0.5	110	1.0	170	1.6
51	1 27.8	1 28.0	1 23.8	51	0.5	111	1.0	171	1.6
52	1 28.0	1 28.2	1 24.0	52	0.5	112	1.0	172	1.6
53	1 28.3	1 28.5	1 24.2	53	0.5	113	1.0	173	1.6
54	1 28.5	1 28.7	1 24.5	54	0.5	114	1.0	174	1.6
55	1 28.8	1 29.0	1 24.7	55	0.5	115	1.1	175	1.6
56	1 29.0	1 29.2	1 24.9	56	0.5	116	1.1	176	1.6
57	1 29.3	1 29.5	1 25.2	57	0.5	117	1.1	177	1.6
58	1 29.5	1 29.7	1 25.4	58	0.5	118	1.1	178	1.6
59	1 29.8	1 30.0	1 25.7	59	0.5	119	1.1	179	1.6
60	1 30.0	1 30.2	1 25.9	60	0.6	120	1.1	180	1.7

6m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	1 30.0	1 30.2	1 25.9	0	0.0	60	0.7	120	1.3
1	1 30.3	1 30.5	1 26.1	1	0.0	61	0.7	121	1.3
2	1 30.5	1 30.7	1 26.4	2	0.0	62	0.7	122	1.3
3	1 30.8	1 31.0	1 26.6	3	0.0	63	0.7	123	1.3
4	1 31.0	1 31.2	1 26.9	4	0.0	64	0.7	124	1.3
5	1 31.3	1 31.5	1 27.1	5	0.1	65	0.7	125	1.4
6	1 31.5	1 31.8	1 27.3	6	0.1	66	0.7	126	1.4
7	1 31.8	1 32.0	1 27.6	7	0.1	67	0.7	127	1.4
8	1 32.0	1 32.3	1 27.8	8	0.1	68	0.7	128	1.4
9	1 32.3	1 32.5	1 28.0	9	0.1	69	0.7	129	1.4
10	1 32.5	1 32.8	1 28.3	10	0.1	70	0.8	130	1.4
11	1 32.8	1 33.0	1 28.5	11	0.1	71	0.8	131	1.4
12	1 33.0	1 33.3	1 28.8	12	0.1	72	0.8	132	1.4
13	1 33.3	1 33.5	1 29.0	13	0.1	73	0.8	133	1.4
14	1 33.5	1 33.8	1 29.2	14	0.2	74	0.8	134	1.5
15	1 33.8	1 34.0	1 29.5	15	0.2	75	0.8	135	1.5
16	1 34.0	1 34.3	1 29.7	16	0.2	76	0.8	136	1.5
17	1 34.3	1 34.5	1 30.0	17	0.2	77	0.8	137	1.5
18	1 34.5	1 34.8	1 30.2	18	0.2	78	0.8	138	1.5
19	1 34.8	1 35.0	1 30.4	19	0.2	79	0.9	139	1.5
20	1 35.0	1 35.3	1 30.7	20	0.2	80	0.9	140	1.5
21	1 35.3	1 35.5	1 30.9	21	0.2	81	0.9	141	1.5
22	1 35.5	1 35.8	1 31.1	22	0.2	82	0.9	142	1.5
23	1 35.8	1 36.0	1 31.4	23	0.2	83	0.9	143	1.5
24	1 36.0	1 36.3	1 31.6	24	0.3	84	0.9	144	1.6
25	1 36.3	1 36.5	1 31.9	25	0.3	85	0.9	145	1.6
26	1 36.5	1 36.8	1 32.1	26	0.3	86	0.9	146	1.6
27	1 36.8	1 37.0	1 32.3	27	0.3	87	0.9	147	1.6
28	1 37.0	1 37.3	1 32.6	28	0.3	88	1.0	148	1.6
29	1 37.3	1 37.5	1 32.8	29	0.3	89	1.0	149	1.6
30	1 37.5	1 37.8	1 33.1	30	0.3	90	1.0	150	1.6
31	1 37.8	1 38.0	1 33.3	31	0.3	91	1.0	151	1.6
32	1 38.0	1 38.3	1 33.5	32	0.3	92	1.0	152	1.6
33	1 38.3	1 38.5	1 33.8	33	0.4	93	1.0	153	1.7
34	1 38.5	1 38.8	1 34.0	34	0.4	94	1.0	154	1.7
35	1 38.8	1 39.0	1 34.3	35	0.4	95	1.0	155	1.7
36	1 39.0	1 39.3	1 34.5	36	0.4	96	1.0	156	1.7
37	1 39.3	1 39.5	1 34.7	37	0.4	97	1.1	157	1.7
38	1 39.5	1 39.8	1 35.0	38	0.4	98	1.1	158	1.7
39	1 39.8	1 40.0	1 35.2	39	0.4	99	1.1	159	1.7
40	1 40.0	1 40.3	1 35.4	40	0.4	100	1.1	160	1.7
41	1 40.3	1 40.5	1 35.7	41	0.4	101	1.1	161	1.7
42	1 40.5	1 40.8	1 35.9	42	0.5	102	1.1	162	1.8
43	1 40.8	1 41.0	1 36.2	43	0.5	103	1.1	163	1.8
44	1 41.0	1 41.3	1 36.4	44	0.5	104	1.1	164	1.8
45	1 41.3	1 41.5	1 36.6	45	0.5	105	1.1	165	1.8
46	1 41.5	1 41.8	1 36.9	46	0.5	106	1.1	166	1.8
47	1 41.8	1 42.0	1 37.1	47	0.5	107	1.2	167	1.8
48	1 42.0	1 42.3	1 37.4	48	0.5	108	1.2	168	1.8
49	1 42.3	1 42.5	1 37.6	49	0.5	109	1.2	169	1.8
50	1 42.5	1 42.8	1 37.8	50	0.5	110	1.2	170	1.8
51	1 42.8	1 43.0	1 38.1	51	0.6	111	1.2	171	1.9
52	1 43.0	1 43.3	1 38.3	52	0.6	112	1.2	172	1.9
53	1 43.3	1 43.5	1 38.5	53	0.6	113	1.2	173	1.9
54	1 43.5	1 43.8	1 38.8	54	0.6	114	1.2	174	1.9
55	1 43.8	1 44.0	1 39.0	55	0.6	115	1.2	175	1.9
56	1 44.0	1 44.3	1 39.3	56	0.6	116	1.3	176	1.9
57	1 44.3	1 44.5	1 39.5	57	0.6	117	1.3	177	1.9
58	1 44.5	1 44.8	1 39.7	58	0.6	118	1.3	178	1.9
59	1 44.8	1 45.0	1 40.0	59	0.6	119	1.3	179	1.9
60	1 45.0	1 45.3	1 40.2	60	0.7	120	1.3	180	2.0

7m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	1 45.0	1 45.3	1 40.2	0	0.0	60	0.8	120	1.5
1	1 45.3	1 45.5	1 40.5	1	0.0	61	0.8	121	1.5
2	1 45.5	1 45.8	1 40.7	2	0.0	62	0.8	122	1.5
3	1 45.8	1 46.0	1 40.9	3	0.0	63	0.8	123	1.5
4	1 46.0	1 46.3	1 41.2	4	0.1	64	0.8	124	1.6
5	1 46.3	1 46.5	1 41.4	5	0.1	65	0.8	125	1.6
6	1 46.5	1 46.8	1 41.6	6	0.1	66	0.8	126	1.6
7	1 46.8	1 47.0	1 41.9	7	0.1	67	0.8	127	1.6
8	1 47.0	1 47.3	1 42.1	8	0.1	68	0.9	128	1.6
9	1 47.3	1 47.5	1 42.4	9	0.1	69	0.9	129	1.6
10	1 47.5	1 47.8	1 42.6	10	0.1	70	0.9	130	1.6
11	1 47.8	1 48.0	1 42.8	11	0.1	71	0.9	131	1.6
12	1 48.0	1 48.3	1 43.1	12	0.2	72	0.9	132	1.7
13	1 48.3	1 48.5	1 43.3	13	0.2	73	0.9	133	1.7
14	1 48.5	1 48.8	1 43.6	14	0.2	74	0.9	134	1.7
15	1 48.8	1 49.0	1 43.8	15	0.2	75	0.9	135	1.7
16	1 49.0	1 49.3	1 44.0	16	0.2	76	1.0	136	1.7
17	1 49.3	1 49.5	1 44.3	17	0.2	77	1.0	137	1.7
18	1 49.5	1 49.8	1 44.5	18	0.2	78	1.0	138	1.7
19	1 49.8	1 50.1	1 44.8	19	0.2	79	1.0	139	1.7
20	1 50.0	1 50.3	1 45.0	20	0.3	80	1.0	140	1.8
21	1 50.3	1 50.6	1 45.2	21	0.3	81	1.0	141	1.8
22	1 50.5	1 50.8	1 45.5	22	0.3	82	1.0	142	1.8
23	1 50.8	1 51.1	1 45.7	23	0.3	83	1.0	143	1.8
24	1 51.0	1 51.3	1 45.9	24	0.3	84	1.1	144	1.8
25	1 51.3	1 51.6	1 46.2	25	0.3	85	1.1	145	1.8
26	1 51.5	1 51.8	1 46.4	26	0.3	86	1.1	146	1.8
27	1 51.8	1 52.1	1 46.7	27	0.3	87	1.1	147	1.8
28	1 52.0	1 52.3	1 46.9	28	0.4	88	1.1	148	1.9
29	1 52.3	1 52.6	1 47.1	29	0.4	89	1.1	149	1.9
30	1 52.5	1 52.8	1 47.4	30	0.4	90	1.1	150	1.9
31	1 52.8	1 53.1	1 47.6	31	0.4	91	1.1	151	1.9
32	1 53.0	1 53.3	1 47.9	32	0.4	92	1.2	152	1.9
33	1 53.3	1 53.6	1 48.1	33	0.4	93	1.2	153	1.9
34	1 53.5	1 53.8	1 48.3	34	0.4	94	1.2	154	1.9
35	1 53.8	1 54.1	1 48.6	35	0.4	95	1.2	155	1.9
36	1 54.0	1 54.3	1 48.8	36	0.5	96	1.2	156	2.0
37	1 54.3	1 54.6	1 49.0	37	0.5	97	1.2	157	2.0
38	1 54.5	1 54.8	1 49.3	38	0.5	98	1.2	158	2.0
39	1 54.8	1 55.1	1 49.5	39	0.5	99	1.2	159	2.0
40	1 55.0	1 55.3	1 49.8	40	0.5	100	1.3	160	2.0
41	1 55.3	1 55.6	1 50.0	41	0.5	101	1.3	161	2.0
42	1 55.5	1 55.8	1 50.2	42	0.5	102	1.3	162	2.0
43	1 55.8	1 56.1	1 50.5	43	0.5	103	1.3	163	2.0
44	1 56.0	1 56.3	1 50.7	44	0.6	104	1.3	164	2.1
45	1 56.3	1 56.6	1 51.0	45	0.6	105	1.3	165	2.1
46	1 56.5	1 56.8	1 51.2	46	0.6	106	1.3	166	2.1
47	1 56.8	1 57.1	1 51.4	47	0.6	107	1.3	167	2.1
48	1 57.0	1 57.3	1 51.7	48	0.6	108	1.4	168	2.1
49	1 57.3	1 57.6	1 51.9	49	0.6	109	1.4	169	2.1
50	1 57.5	1 57.8	1 52.1	50	0.6	110	1.4	170	2.1
51	1 57.8	1 58.1	1 52.4	51	0.6	111	1.4	171	2.1
52	1 58.0	1 58.3	1 52.6	52	0.7	112	1.4	172	2.2
53	1 58.3	1 58.6	1 52.9	53	0.7	113	1.4	173	2.2
54	1 58.5	1 58.8	1 53.1	54	0.7	114	1.4	174	2.2
55	1 58.8	1 59.1	1 53.3	55	0.7	115	1.4	175	2.2
56	1 59.0	1 59.3	1 53.6	56	0.7	116	1.5	176	2.2
57	1 59.3	1 59.6	1 53.8	57	0.7	117	1.5	177	2.2
58	1 59.5	1 59.8	1 54.1	58	0.7	118	1.5	178	2.2
59	1 59.8	2 00.1	1 54.3	59	0.7	119	1.5	179	2.2
60	2 00.0	2 00.3	1 54.5	60	0.8	120	1.5	180	2.3

8m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	2 00.0	2 00.3	1 54.5	0	0.0	60	0.9	120	1.7
1	2 00.3	2 00.6	1 54.8	1	0.0	61	0.9	121	1.7
2	2 00.5	2 00.8	1 55.0	2	0.0	62	0.9	122	1.7
3	2 00.8	2 01.1	1 55.2	3	0.0	63	0.9	123	1.7
4	2 01.0	2 01.3	1 55.5	4	0.1	64	0.9	124	1.8
5	2 01.3	2 01.6	1 55.7	5	0.1	65	0.9	125	1.8
6	2 01.5	2 01.8	1 56.0	6	0.1	66	0.9	126	1.8
7	2 01.8	2 02.1	1 56.2	7	0.1	67	0.9	127	1.8
8	2 02.0	2 02.3	1 56.4	8	0.1	68	1.0	128	1.8
9	2 02.3	2 02.6	1 56.7	9	0.1	69	1.0	129	1.8
10	2 02.5	2 02.8	1 56.9	10	0.1	70	1.0	130	1.8
11	2 02.8	2 03.1	1 57.2	11	0.2	71	1.0	131	1.9
12	2 03.0	2 03.3	1 57.4	12	0.2	72	1.0	132	1.9
13	2 03.3	2 03.6	1 57.6	13	0.2	73	1.0	133	1.9
14	2 03.5	2 03.8	1 57.9	14	0.2	74	1.0	134	1.9
15	2 03.8	2 04.1	1 58.1	15	0.2	75	1.1	135	1.9
16	2 04.0	2 04.3	1 58.4	16	0.2	76	1.1	136	1.9
17	2 04.3	2 04.6	1 58.6	17	0.2	77	1.1	137	1.9
18	2 04.5	2 04.8	1 58.8	18	0.3	78	1.1	138	2.0
19	2 04.8	2 05.1	1 59.1	19	0.3	79	1.1	139	2.0
20	2 05.0	2 05.3	1 59.3	20	0.3	80	1.1	140	2.0
21	2 05.3	2 05.6	1 59.5	21	0.3	81	1.1	141	2.0
22	2 05.5	2 05.8	1 59.8	22	0.3	82	1.2	142	2.0
23	2 05.8	2 06.1	2 00.0	23	0.3	83	1.2	143	2.0
24	2 06.0	2 06.3	2 00.3	24	0.3	84	1.2	144	2.0
25	2 06.3	2 06.6	2 00.5	25	0.4	85	1.2	145	2.1
26	2 06.5	2 06.8	2 00.7	26	0.4	86	1.2	146	2.1
27	2 06.8	2 07.1	2 01.0	27	0.4	87	1.2	147	2.1
28	2 07.0	2 07.3	2 01.2	28	0.4	88	1.2	148	2.1
29	2 07.3	2 07.6	2 01.5	29	0.4	89	1.3	149	2.1
30	2 07.5	2 07.8	2 01.7	30	0.4	90	1.3	150	2.1
31	2 07.8	2 08.1	2 01.9	31	0.4	91	1.3	151	2.1
32	2 08.0	2 08.4	2 02.2	32	0.5	92	1.3	152	2.2
33	2 08.3	2 08.6	2 02.4	33	0.5	93	1.3	153	2.2
34	2 08.5	2 08.9	2 02.6	34	0.5	94	1.3	154	2.2
35	2 08.8	2 09.1	2 02.9	35	0.5	95	1.3	155	2.2
36	2 09.0	2 09.4	2 03.1	36	0.5	96	1.4	156	2.2
37	2 09.3	2 09.6	2 03.4	37	0.5	97	1.4	157	2.2
38	2 09.5	2 09.9	2 03.6	38	0.5	98	1.4	158	2.2
39	2 09.8	2 10.1	2 03.8	39	0.6	99	1.4	159	2.3
40	2 10.0	2 10.4	2 04.1	40	0.6	100	1.4	160	2.3
41	2 10.3	2 10.6	2 04.3	41	0.6	101	1.4	161	2.3
42	2 10.5	2 10.9	2 04.6	42	0.6	102	1.4	162	2.3
43	2 10.8	2 11.1	2 04.8	43	0.6	103	1.5	163	2.3
44	2 11.0	2 11.4	2 05.0	44	0.6	104	1.5	164	2.3
45	2 11.3	2 11.6	2 05.3	45	0.6	105	1.5	165	2.3
46	2 11.5	2 11.9	2 05.5	46	0.7	106	1.5	166	2.4
47	2 11.8	2 12.1	2 05.7	47	0.7	107	1.5	167	2.4
48	2 12.0	2 12.4	2 06.0	48	0.7	108	1.5	168	2.4
49	2 12.3	2 12.6	2 06.2	49	0.7	109	1.5	169	2.4
50	2 12.5	2 12.9	2 06.5	50	0.7	110	1.6	170	2.4
51	2 12.8	2 13.1	2 06.7	51	0.7	111	1.6	171	2.4
52	2 13.0	2 13.4	2 06.9	52	0.7	112	1.6	172	2.4
53	2 13.3	2 13.6	2 07.2	53	0.8	113	1.6	173	2.5
54	2 13.5	2 13.9	2 07.4	54	0.8	114	1.6	174	2.5
55	2 13.8	2 14.1	2 07.7	55	0.8	115	1.6	175	2.5
56	2 14.0	2 14.4	2 07.9	56	0.8	116	1.6	176	2.5
57	2 14.3	2 14.6	2 08.1	57	0.8	117	1.7	177	2.5
58	2 14.5	2 14.9	2 08.4	58	0.8	118	1.7	178	2.5
59	2 14.8	2 15.1	2 08.6	59	0.8	119	1.7	179	2.5
60	2 15.0	2 15.4	2 08.9	60	0.9	120	1.7	180	2.6

9m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	2 15.0	2 15.4	2 08.9	0	0.0	60	1.0	120	1.9
1	2 15.3	2 15.6	2 09.1	1	0.0	61	1.0	121	1.9
2	2 15.5	2 15.9	2 09.3	2	0.0	62	1.0	122	1.9
3	2 15.8	2 16.1	2 09.6	3	0.0	63	1.0	123	1.9
4	2 16.0	2 16.4	2 09.8	4	0.1	64	1.0	124	2.0
5	2 16.3	2 16.6	2 10.0	5	0.1	65	1.0	125	2.0
6	2 16.5	2 16.9	2 10.3	6	0.1	66	1.0	126	2.0
7	2 16.8	2 17.1	2 10.5	7	0.1	67	1.1	127	2.0
8	2 17.0	2 17.4	2 10.8	8	0.1	68	1.1	128	2.0
9	2 17.3	2 17.6	2 11.0	9	0.1	69	1.1	129	2.0
10	2 17.5	2 17.9	2 11.2	10	0.2	70	1.1	130	2.1
11	2 17.8	2 18.1	2 11.5	11	0.2	71	1.1	131	2.1
12	2 18.0	2 18.4	2 11.7	12	0.2	72	1.1	132	2.1
13	2 18.3	2 18.6	2 12.0	13	0.2	73	1.2	133	2.1
14	2 18.5	2 18.9	2 12.2	14	0.2	74	1.2	134	2.1
15	2 18.8	2 19.1	2 12.4	15	0.2	75	1.2	135	2.1
16	2 19.0	2 19.4	2 12.7	16	0.3	76	1.2	136	2.2
17	2 19.3	2 19.6	2 12.9	17	0.3	77	1.2	137	2.2
18	2 19.5	2 19.9	2 13.1	18	0.3	78	1.2	138	2.2
19	2 19.8	2 20.1	2 13.4	19	0.3	79	1.3	139	2.2
20	2 20.0	2 20.4	2 13.6	20	0.3	80	1.3	140	2.2
21	2 20.3	2 20.6	2 13.9	21	0.3	81	1.3	141	2.2
22	2 20.5	2 20.9	2 14.1	22	0.3	82	1.3	142	2.2
23	2 20.8	2 21.1	2 14.3	23	0.4	83	1.3	143	2.3
24	2 21.0	2 21.4	2 14.6	24	0.4	84	1.3	144	2.3
25	2 21.3	2 21.6	2 14.8	25	0.4	85	1.3	145	2.3
26	2 21.5	2 21.9	2 15.1	26	0.4	86	1.4	146	2.3
27	2 21.8	2 22.1	2 15.3	27	0.4	87	1.4	147	2.3
28	2 22.0	2 22.4	2 15.5	28	0.4	88	1.4	148	2.3
29	2 22.3	2 22.6	2 15.8	29	0.5	89	1.4	149	2.4
30	2 22.5	2 22.9	2 16.0	30	0.5	90	1.4	150	2.4
31	2 22.8	2 23.1	2 16.2	31	0.5	91	1.4	151	2.4
32	2 23.0	2 23.4	2 16.5	32	0.5	92	1.5	152	2.4
33	2 23.3	2 23.6	2 16.7	33	0.5	93	1.5	153	2.4
34	2 23.5	2 23.9	2 17.0	34	0.5	94	1.5	154	2.4
35	2 23.8	2 24.1	2 17.2	35	0.6	95	1.5	155	2.5
36	2 24.0	2 24.4	2 17.4	36	0.6	96	1.5	156	2.5
37	2 24.3	2 24.6	2 17.7	37	0.6	97	1.5	157	2.5
38	2 24.5	2 24.9	2 17.9	38	0.6	98	1.6	158	2.5
39	2 24.8	2 25.1	2 18.2	39	0.6	99	1.6	159	2.5
40	2 25.0	2 25.4	2 18.4	40	0.6	100	1.6	160	2.5
41	2 25.3	2 25.6	2 18.6	41	0.6	101	1.6	161	2.5
42	2 25.5	2 25.9	2 18.9	42	0.7	102	1.6	162	2.6
43	2 25.8	2 26.1	2 19.1	43	0.7	103	1.6	163	2.6
44	2 26.0	2 26.4	2 19.3	44	0.7	104	1.6	164	2.6
45	2 26.3	2 26.7	2 19.6	45	0.7	105	1.7	165	2.6
46	2 26.5	2 26.9	2 19.8	46	0.7	106	1.7	166	2.6
47	2 26.8	2 27.2	2 20.1	47	0.7	107	1.7	167	2.6
48	2 27.0	2 27.4	2 20.3	48	0.8	108	1.7	168	2.7
49	2 27.3	2 27.7	2 20.5	49	0.8	109	1.7	169	2.7
50	2 27.5	2 27.9	2 20.8	50	0.8	110	1.7	170	2.7
51	2 27.8	2 28.2	2 21.0	51	0.8	111	1.8	171	2.7
52	2 28.0	2 28.4	2 21.3	52	0.8	112	1.8	172	2.7
53	2 28.3	2 28.7	2 21.5	53	0.8	113	1.8	173	2.7
54	2 28.5	2 28.9	2 21.7	54	0.9	114	1.8	174	2.8
55	2 28.8	2 29.2	2 22.0	55	0.9	115	1.8	175	2.8
56	2 29.0	2 29.4	2 22.2	56	0.9	116	1.8	176	2.8
57	2 29.3	2 29.7	2 22.5	57	0.9	117	1.9	177	2.8
58	2 29.5	2 29.9	2 22.7	58	0.9	118	1.9	178	2.8
59	2 29.8	2 30.2	2 22.9	59	0.9	119	1.9	179	2.8
60	2.30.0	2 30.4	2 23.2	60	1.0	120	1.9	180	2.9

10m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	2 30.0	2 30.4	2 23.2	0	0.0	60	1.1	120	2.1
1	2 30.3	2 30.7	2 23.4	1	0.0	61	1.1	121	2.1
2	2 30.5	2 30.9	2 23.6	2	0.0	62	1.1	122	2.1
3	2 30.8	2 31.2	2 23.9	3	0.1	63	1.1	123	2.2
4	2 31.0	2 31.4	2 24.1	4	0.1	64	1.1	124	2.2
5	2 31.3	2 31.7	2 24.4	5	0.1	65	1.1	125	2.2
6	2 31.5	2 31.9	2 24.6	6	0.1	66	1.2	126	2.2
7	2 31.8	2 32.2	2 24.8	7	0.1	67	1.2	127	2.2
8	2 32.0	2 32.4	2 25.1	8	0.1	68	1.2	128	2.2
9	2 32.3	2 32.7	2 25.3	9	0.2	69	1.2	129	2.3
10	2 32.5	2 32.9	2 25.6	10	0.2	70	1.2	130	2.3
11	2 32.8	2 33.2	2 25.8	11	0.2	71	1.2	131	2.3
12	2 33.0	2 33.4	2 26.0	12	0.2	72	1.3	132	2.3
13	2 33.3	2 33.7	2 26.3	13	0.2	73	1.3	133	2.3
14	2 33.5	2 33.9	2 26.5	14	0.2	74	1.3	134	2.3
15	2 33.8	2 34.2	2 26.7	15	0.3	75	1.3	135	2.4
16	2 34.0	2 34.4	2 27.0	16	0.3	76	1.3	136	2.4
17	2 34.3	2 34.7	2 27.2	17	0.3	77	1.3	137	2.4
18	2 34.5	2 34.9	2 27.5	18	0.3	78	1.4	138	2.4
19	2 34.8	2 35.2	2 27.7	19	0.3	79	1.4	139	2.4
20	2 35.0	2 35.4	2 27.9	20	0.4	80	1.4	140	2.5
21	2 35.3	2 35.7	2 28.2	21	0.4	81	1.4	141	2.5
22	2 35.5	2 35.9	2 28.4	22	0.4	82	1.4	142	2.5
23	2 35.8	2 36.2	2 28.7	23	0.4	83	1.5	143	2.5
24	2 36.0	2 36.4	2 28.9	24	0.4	84	1.5	144	2.5
25	2 36.3	2 36.7	2 29.1	25	0.4	85	1.5	145	2.5
26	2 36.5	2 36.9	2 29.4	26	0.5	86	1.5	146	2.6
27	2 36.8	2 37.2	2 29.6	27	0.5	87	1.5	147	2.6
28	2 37.0	2 37.4	2 29.8	28	0.5	88	1.5	148	2.6
29	2 37.3	2 37.7	2 30.1	29	0.5	89	1.6	149	2.6
30	2 37.5	2 37.9	2 30.3	30	0.5	90	1.6	150	2.6
31	2 37.8	2 38.2	2 30.6	31	0.5	91	1.6	151	2.6
32	2 38.0	2 38.4	2 30.8	32	0.6	92	1.6	152	2.7
33	2 38.3	2 38.7	2 31.0	33	0.6	93	1.6	153	2.7
34	2 38.5	2 38.9	2 31.3	34	0.6	94	1.6	154	2.7
35	2 38.8	2 39.2	2 31.5	35	0.6	95	1.7	155	2.7
36	2 39.0	2 39.4	2 31.8	36	0.6	96	1.7	156	2.7
37	2 39.3	2 39.7	2 32.0	37	0.6	97	1.7	157	2.7
38	2 39.5	2 39.9	2 32.2	38	0.7	98	1.7	158	2.8
39	2 39.8	2 40.2	2 32.5	39	0.7	99	1.7	159	2.8
40	2 40.0	2 40.4	2 32.7	40	0.7	100	1.8	160	2.8
41	2 40.3	2 40.7	2 32.9	41	0.7	101	1.8	161	2.8
42	2 40.5	2 40.9	2 33.2	42	0.7	102	1.8	162	2.8
43	2 40.8	2 41.2	2 33.4	43	0.8	103	1.8	163	2.9
44	2 41.0	2 41.4	2 33.7	44	0.8	104	1.8	164	2.9
45	2 41.3	2 41.7	2 33.9	45	0.8	105	1.8	165	2.9
46	2 41.5	2 41.9	2 34.1	46	0.8	106	1.9	166	2.9
47	2 41.8	2 42.2	2 34.4	47	0.8	107	1.9	167	2.9
48	2 42.0	2 42.4	2 34.6	48	0.8	108	1.9	168	2.9
49	2 42.3	2 42.7	2 34.9	49	0.9	109	1.9	169	3.0
50	2 42.5	2 42.9	2 35.1	50	0.9	110	1.9	170	3.0
51	2 42.8	2 43.2	2 35.3	51	0.9	111	1.9	171	3.0
52	2 43.0	2 43.4	2 35.6	52	0.9	112	2.0	172	3.0
53	2 43.3	2 43.7	2 35.8	53	0.9	113	2.0	173	3.0
54	2 43.5	2 43.9	2 36.1	54	0.9	114	2.0	174	3.0
55	2 43.8	2 44.2	2 36.3	55	1.0	115	2.0	175	3.1
56	2 44.0	2 44.4	2 36.5	56	1.0	116	2.0	176	3.1
57	2 44.3	2 44.7	2 36.8	57	1.0	117	2.0	177	3.1
58	2 44.5	2 45.0	2 37.0	58	1.0	118	2.1	178	3.1
59	2 44.8	2 45.2	2 37.2	59	1.0	119	2.1	179	3.1
60	2 45.0	2 45.5	2 37.5	60	1.1	120	2.1	180	3.2

11m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	2 45.0	2 45.5	2 37.5	0	0.0	60	1.2	120	2.3
1	2 45.3	2 45.7	2 37.7	1	0.0	61	1.2	121	2.3
2	2 45.5	2 46.0	2 38.0	2	0.0	62	1.2	122	2.3
3	2 45.8	2 46.2	2 38.2	3	0.1	63	1.2	123	2.4
4	2 46.0	2 46.5	2 38.4	4	0.1	64	1.2	124	2.4
5	2 46.3	2 46.7	2 38.7	5	0.1	65	1.2	125	2.4
6	2 46.5	2 47.0	2 38.9	6	0.1	66	1.3	126	2.4
7	2 46.8	2 47.2	2 39.2	7	0.1	67	1.3	127	2.4
8	2 47.0	2 47.5	2 39.4	8	0.2	68	1.3	128	2.5
9	2 47.3	2 47.7	2 39.6	9	0.2	69	1.3	129	2.5
10	2 47.5	2 48.0	2 39.9	10	0.2	70	1.3	130	2.5
11	2 47.8	2 48.2	2 40.1	11	0.2	71	1.4	131	2.5
12	2 48.0	2 48.5	2 40.3	12	0.2	72	1.4	132	2.5
13	2 48.3	2 48.7	2 40.6	13	0.2	73	1.4	133	2.5
14	2 48.5	2 49.0	2 40.8	14	0.3	74	1.4	134	2.6
15	2 48.8	2 49.2	2 41.1	15	0.3	75	1.4	135	2.6
16	2 49.0	2 49.5	2 41.3	16	0.3	76	1.5	136	2.6
17	2 49.3	2 49.7	2 41.5	17	0.3	77	1.5	137	2.6
18	2 49.5	2 50.0	2 41.8	18	0.3	78	1.5	138	2.6
19	2 49.8	2 50.2	2 42.0	19	0.4	79	1.5	139	2.7
20	2 50.0	2 50.5	2 42.3	20	0.4	80	1.5	140	2.7
21	2 50.3	2 50.7	2 42.5	21	0.4	81	1.6	141	2.7
22	2 50.5	2 51.0	2 42.7	22	0.4	82	1.6	142	2.7
23	2 50.8	2 51.2	2 43.0	23	0.4	83	1.6	143	2.7
24	2 51.0	2 51.5	2 43.2	24	0.5	84	1.6	144	2.8
25	2 51.3	2 51.7	2 43.4	25	0.5	85	1.6	145	2.8
26	2 51.5	2 52.0	2 43.7	26	0.5	86	1.6	146	2.8
27	2 51.8	2 52.2	2 43.9	27	0.5	87	1.7	147	2.8
28	2 52.0	2 52.5	2 44.2	28	0.5	88	1.7	148	2.8
29	2 52.3	2 52.7	2 44.4	29	0.6	89	1.7	149	2.9
30	2 52.5	2 53.0	2 44.6	30	0.6	90	1.7	150	2.9
31	2 52.8	2 53.2	2 44.9	31	0.6	91	1.7	151	2.9
32	2 53.0	2 53.5	2 45.1	32	0.6	92	1.8	152	2.9
33	2 53.3	2 53.7	2 45.4	33	0.6	93	1.8	153	2.9
34	2 53.5	2 54.0	2 45.6	34	0.7	94	1.8	154	3.0
35	2 53.8	2 54.2	2 45.8	35	0.7	95	1.8	155	3.0
36	2 54.0	2 54.5	2 46.1	36	0.7	96	1.8	156	3.0
37	2 54.3	2 54.7	2 46.3	37	0.7	97	1.9	157	3.0
38	2 54.5	2 55.0	2 46.6	38	0.7	98	1.9	158	3.0
39	2 54.8	2 55.2	2 46.8	39	0.7	99	1.9	159	3.0
40	2 55.0	2 55.5	2 47.0	40	0.8	100	1.9	160	3.1
41	2 55.3	2 55.7	2 47.3	41	0.8	101	1.9	161	3.1
42	2 55.5	2 56.0	2 47.5	42	0.8	102	2.0	162	3.1
43	2 55.8	2 56.2	2 47.7	43	0.8	103	2.0	163	3.1
44	2 56.0	2 56.5	2 48.0	44	0.8	104	2.0	164	3.1
45	2 56.3	2 56.7	2 48.2	45	0.9	105	2.0	165	3.2
46	2 56.5	2 57.0	2 48.5	46	0.9	106	2.0	166	3.2
47	2 56.8	2 57.2	2 48.7	47	0.9	107	2.1	167	3.2
48	2 57.0	2 57.5	2 48.9	48	0.9	108	2.1	168	3.2
49	2 57.3	2 57.7	2 49.2	49	0.9	109	2.1	169	3.2
50	2 57.5	2 58.0	2 49.4	50	1.0	110	2.1	170	3.3
51	2 57.8	2 58.2	2 49.7	51	1.0	111	2.1	171	3.3
52	2 58.0	2 58.5	2 49.9	52	1.0	112	2.1	172	3.3
53	2 58.3	2 58.7	2 50.1	53	1.0	113	2.2	173	3.3
54	2 58.5	2 59.0	2 50.4	54	1.0	114	2.2	174	3.3
55	2 58.8	2 59.2	2 50.6	55	1.1	115	2.2	175	3.4
56	2 59.0	2 59.5	2 50.8	56	1.1	116	2.2	176	3.4
57	2 59.3	2 59.7	2 51.1	57	1.1	117	2.2	177	3.4
58	2 59.5	3 00.0	2 51.3	58	1.1	118	2.3	178	3.4
59	2 59.8	3 00.2	2 51.6	59	1.1	119	2.3	179	3.4
60	3 00.0	3 00.5	2 51.8	60	1.2	120	2.3	180	3.5

12m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	3 00.0	3 00.5	2 51.8	0	0.0	60	1.3	120	2.5
1	3 00.3	3 00.7	2 52.0	1	0.0	61	1.3	121	2.5
2	3 00.5	3 01.0	2 52.3	2	0.0	62	1.3	122	2.5
3	3 00.8	3 01.2	2 52.5	3	0.1	63	1.3	123	2.6
4	3 01.0	3 01.5	2 52.8	4	0.1	64	1.3	124	2.6
5	3 01.3	3 01.7	2 53.0	5	0.1	65	1.4	125	2.6
6	3 01.5	3 02.0	2 53.2	6	0.1	66	1.4	126	2.6
7	3 01.8	3 02.2	2 53.5	7	0.1	67	1.4	127	2.6
8	3 02.0	3 02.5	2 53.7	8	0.2	68	1.4	128	2.7
9	3 02.3	3 02.7	2 53.9	9	0.2	69	1.4	129	2.7
10	3 02.5	3 03.0	2 54.2	10	0.2	70	1.5	130	2.7
11	3 02.8	3 03.3	2 54.4	11	0.2	71	1.5	131	2.7
12	3 03.0	3 03.5	2 54.7	12	0.3	72	1.5	132	2.8
13	3 03.3	3 03.8	2 54.9	13	0.3	73	1.5	133	2.8
14	3 03.5	3 04.0	2 55.1	14	0.3	74	1.5	134	2.8
15	3 03.8	3 04.3	2 55.4	15	0.3	75	1.6	135	2.8
16	3 04.0	3 04.5	2 55.6	16	0.3	76	1.6	136	2.8
17	3 04.3	3 04.8	2 55.9	17	0.4	77	1.6	137	2.9
18	3 04.5	3 05.0	2 56.1	18	0.4	78	1.6	138	2.9
19	3 04.8	3 05.3	2 56.3	19	0.4	79	1.6	139	2.9
20	3 05.0	3 05.5	2 56.6	20	0.4	80	1.7	140	2.9
21	3 05.3	3 05.8	2 56.8	21	0.4	81	1.7	141	2.9
22	3 05.5	3 06.0	2 57.0	22	0.5	82	1.7	142	3.0
23	3 05.8	3 06.3	2 57.3	23	0.5	83	1.7	143	3.0
24	3 06.0	3 06.5	2 57.5	24	0.5	84	1.8	144	3.0
25	3 06.3	3 06.8	2 57.8	25	0.5	85	1.8	145	3.0
26	3 06.5	3 07.0	2 58.0	26	0.5	86	1.8	146	3.0
27	3 06.8	3 07.3	2 58.2	27	0.6	87	1.8	147	3.1
28	3 07.0	3 07.5	2 58.5	28	0.6	88	1.8	148	3.1
29	3 07.3	3 07.8	2 58.7	29	0.6	89	1.9	149	3.1
30	3 07.5	3 08.0	2 59.0	30	0.6	90	1.9	150	3.1
31	3 07.8	3 08.3	2 59.2	31	0.6	91	1.9	151	3.1
32	3 08.0	3 08.5	2 59.4	32	0.7	92	1.9	152	3.2
33	3 08.3	3 08.8	2 59.7	33	0.7	93	1.9	153	3.2
34	3 08.5	3 09.0	2 59.9	34	0.7	94	2.0	154	3.2
35	3 08.8	3 09.3	3 00.2	35	0.7	95	2.0	155	3.2
36	3 09.0	3 09.5	3 00.4	36	0.8	96	2.0	156	3.3
37	3 09.3	3 09.8	3 00.6	37	0.8	97	2.0	157	3.3
38	3 09.5	3 10.0	3 00.9	38	0.8	98	2.0	158	3.3
39	3 09.8	3 10.3	3 01.1	39	0.8	99	2.1	159	3.3
40	3 10.0	3 10.5	3 01.3	40	0.8	100	2.1	160	3.3
41	3 10.3	3 10.8	3 01.6	41	0.9	101	2.1	161	3.4
42	3 10.5	3 11.0	3 01.8	42	0.9	102	2.1	162	3.4
43	3 10.8	3 11.3	3 02.1	43	0.9	103	2.1	163	3.4
44	3 11.0	3 11.5	3 02.3	44	0.9	104	2.2	164	3.4
45	3 11.3	3 11.8	3 02.5	45	0.9	105	2.2	165	3.4
46	3 11.5	3 12.0	3 02.8	46	1.0	106	2.2	166	3.5
47	3 11.8	3 12.3	3 03.0	47	1.0	107	2.2	167	3.5
48	3 12.0	3 12.5	3 03.3	48	1.0	108	2.3	168	3.5
49	3 12.3	3 12.8	3 03.5	49	1.0	109	2.3	169	3.5
50	3 12.5	3 13.0	3 03.7	50	1.0	110	2.3	170	3.5
51	3 12.8	3 13.3	3 04.0	51	1.1	111	2.3	171	3.6
52	3 13.0	3 13.5	3 04.2	52	1.1	112	2.3	172	3.6
53	3 13.3	3 13.8	3 04.4	53	1.1	113	2.4	173	3.6
54	3 13.5	3 14.0	3 04.7	54	1.1	114	2.4	174	3.6
55	3 13.8	3 14.3	3 04.9	55	1.1	115	2.4	175	3.6
56	3 14.0	3 14.5	3 05.2	56	1.2	116	2.4	176	3.7
57	3 14.3	3 14.8	3 05.4	57	1.2	117	2.4	177	3.7
58	3 14.5	3 15.0	3 05.6	58	1.2	118	2.5	178	3.7
59	3 14.8	3 15.3	3 05.9	59	1.2	119	2.5	179	3.7
60	3 15.0	3 15.5	3 06.1	60	1.3	120	2.5	180	3.8

13m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	3 15.0	3 15.5	3 06.1	0	0.0	60	1.4	120	2.7
1	3 15.3	3 15.8	3 06.4	1	0.0	61	1.4	121	2.7
2	3 15.5	3 16.0	3 06.6	2	0.0	62	1.4	122	2.7
3	3 15.8	3 16.3	3 06.8	3	0.1	63	1.4	123	2.8
4	3 16.0	3 16.5	3 07.1	4	0.1	64	1.4	124	2.8
5	3 16.3	3 16.8	3 07.3	5	0.1	65	1.5	125	2.8
6	3 16.5	3 17.0	3 07.5	6	0.1	66	1.5	126	2.8
7	3 16.8	3 17.3	3 07.8	7	0.2	67	1.5	127	2.9
8	3 17.0	3 17.5	3 08.0	8	0.2	68	1.5	128	2.9
9	3 17.3	3 17.8	3 08.3	9	0.2	69	1.6	129	2.9
10	3 17.5	3 18.0	3 08.5	10	0.2	70	1.6	130	2.9
11	3 17.8	3 18.3	3 08.7	11	0.2	71	1.6	131	2.9
12	3 18.0	3 18.5	3 09.0	12	0.3	72	1.6	132	3.0
13	3 18.3	3 18.8	3 09.2	13	0.3	73	1.6	133	3.0
14	3 18.5	3 19.0	3 09.5	14	0.3	74	1.7	134	3.0
15	3 18.8	3 19.3	3 09.7	15	0.3	75	1.7	135	3.0
16	3 19.0	3 19.5	3 09.9	16	0.4	76	1.7	136	3.1
17	3 19.3	3 19.8	3 10.2	17	0.4	77	1.7	137	3.1
18	3 19.5	3 20.0	3 10.4	18	0.4	78	1.8	138	3.1
19	3 19.8	3 20.3	3 10.7	19	0.4	79	1.8	139	3.1
20	3 20.0	3 20.5	3 10.9	20	0.5	80	1.8	140	3.2
21	3 20.3	3 20.8	3 11.1	21	0.5	81	1.8	141	3.2
22	3 20.5	3 21.0	3 11.4	22	0.5	82	1.8	142	3.2
23	3 20.8	3 21.3	3 11.6	23	0.5	83	1.9	143	3.2
24	3 21.0	3 21.6	3 11.8	24	0.5	84	1.9	144	3.2
25	3 21.3	3 21.8	3 12.1	25	0.6	85	1.9	145	3.3
26	3 21.5	3 22.1	3 12.3	26	0.6	86	1.9	146	3.3
27	3 21.8	3 22.3	3 12.6	27	0.6	87	2.0	147	3.3
28	3 22.0	3 22.6	3 12.8	28	0.6	88	2.0	148	3.3
29	3 22.3	3 22.8	3 13.0	29	0.7	89	2.0	149	3.4
30	3 22.5	3 23.1	3 13.3	30	0.7	90	2.0	150	3.4
31	3 22.8	3 23.3	3 13.5	31	0.7	91	2.0	151	3.4
32	3 23.0	3 23.6	3 13.8	32	0.7	92	2.1	152	3.4
33	3 23.3	3 23.8	3 14.0	33	0.7	93	2.1	153	3.4
34	3 23.5	3 24.1	3 14.2	34	0.8	94	2.1	154	3.5
35	3 23.8	3 24.3	3 14.5	35	0.8	95	2.1	155	3.5
36	3 24.0	3 24.6	3 14.7	36	0.8	96	2.2	156	3.5
37	3 24.3	3 24.8	3 14.9	37	0.8	97	2.2	157	3.5
38	3 24.5	3 25.1	3 15.2	38	0.9	98	2.2	158	3.6
39	3 24.8	3 25.3	3 15.4	39	0.9	99	2.2	159	3.6
40	3 25.0	3 25.6	3 15.7	40	0.9	100	2.3	160	3.6
41	3 25.3	3 25.8	3 15.9	41	0.9	101	2.3	161	3.6
42	3 25.5	3 26.1	3 16.1	42	0.9	102	2.3	162	3.6
43	3 25.8	3 26.3	3 16.4	43	1.0	103	2.3	163	3.7
44	3 26.0	3 26.6	3 16.6	44	1.0	104	2.3	164	3.7
45	3 26.3	3 26.8	3 16.9	45	1.0	105	2.4	165	3.7
46	3 26.5	3 27.1	3 17.1	46	1.0	106	2.4	166	3.7
47	3 26.8	3 27.3	3 17.3	47	1.1	107	2.4	167	3.8
48	3 27.0	3 27.6	3 17.6	48	1.1	108	2.4	168	3.8
49	3 27.3	3 27.8	3 17.8	49	1.1	109	2.5	169	3.8
50	3 27.5	3 28.1	3 18.0	50	1.1	110	2.5	170	3.8
51	3 27.8	3 28.3	3 18.3	51	1.1	111	2.5	171	3.8
52	3 28.0	3 28.6	3 18.5	52	1.2	112	2.5	172	3.9
53	3 28.3	3 28.8	3 18.8	53	1.2	113	2.5	173	3.9
54	3 28.5	3 29.1	3 19.0	54	1.2	114	2.6	174	3.9
55	3 28.8	3 29.3	3 19.2	55	1.2	115	2.6	175	3.9
56	3 29.0	3 29.6	3 19.5	56	1.3	116	2.6	176	4.0
57	3 29.3	3 29.8	3 19.7	57	1.3	117	2.6	177	4.0
58	3 29.5	3 30.1	3 20.0	58	1.3	118	2.7	178	4.0
59	3 29.8	3 30.3	3 20.2	59	1.3	119	2.7	179	4.0
60	3 30.0	3 30.6	3 20.4	60	1.4	120	2.7	180	4.1

14m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	3 30.0	3 30.6	3 20.4	0	0.0	60	1.5	120	2.9
1	3 30.3	3 30.8	3 20.7	1	0.0	61	1.5	121	2.9
2	3 30.5	3 31.1	3 20.9	2	0.0	62	1.5	122	2.9
3	3 30.8	3 31.3	3 21.1	3	0.1	63	1.5	123	3.0
4	3 31.0	3 31.6	3 21.4	4	0.1	64	1.5	124	3.0
5	3 31.3	3 31.8	3 21.6	5	0.1	65	1.6	125	3.0
6	3 31.5	3 32.1	3 21.9	6	0.1	66	1.6	126	3.0
7	3 31.8	3 32.3	3 22.1	7	0.2	67	1.6	127	3.1
8	3 32.0	3 32.6	3 22.3	8	0.2	68	1.6	128	3.1
9	3 32.3	3 32.8	3 22.6	9	0.2	69	1.7	129	3.1
10	3 32.5	3 33.1	3 22.8	10	0.2	70	1.7	130	3.1
11	3 32.8	3 33.3	3 23.1	11	0.3	71	1.7	131	3.2
12	3 33.0	3 33.6	3 23.3	12	0.3	72	1.7	132	3.2
13	3 33.3	3 33.8	3 23.5	13	0.3	73	1.8	133	3.2
14	3 33.5	3 34.1	3 23.8	14	0.3	74	1.8	134	3.2
15	3 33.8	3 34.3	3 24.0	15	0.4	75	1.8	135	3.3
16	3 34.0	3 34.6	3 24.3	16	0.4	76	1.8	136	3.3
17	3 34.3	3 34.8	3 24.5	17	0.4	77	1.9	137	3.3
18	3 34.5	3 35.1	3 24.7	18	0.4	78	1.9	138	3.3
19	3 34.8	3 35.3	3 25.0	19	0.5	79	1.9	139	3.4
20	3 35.0	3 35.6	3 25.2	20	0.5	80	1.9	140	3.4
21	3 35.3	3 35.8	3 25.4	21	0.5	81	2.0	141	3.4
22	3 35.5	3 36.1	3 25.7	22	0.5	82	2.0	142	3.4
23	3 35.8	3 36.3	3 25.9	23	0.6	83	2.0	143	3.5
24	3 36.0	3 36.6	3 26.2	24	0.6	84	2.0	144	3.5
25	3 36.3	3 36.8	3 26.4	25	0.6	85	2.1	145	3.5
26	3 36.5	3 37.1	3 26.6	26	0.6	86	2.1	146	3.5
27	3 36.8	3 37.3	3 26.9	27	0.7	87	2.1	147	3.6
28	3 37.0	3 37.6	3 27.1	28	0.7	88	2.1	148	3.6
29	3 37.3	3 37.8	3 27.4	29	0.7	89	2.2	149	3.6
30	3 37.5	3 38.1	3 27.6	30	0.7	90	2.2	150	3.6
31	3 37.8	3 38.3	3 27.8	31	0.7	91	2.2	151	3.6
32	3 38.0	3 38.6	3 28.1	32	0.8	92	2.2	152	3.7
33	3 38.3	3 38.8	3 28.3	33	0.8	93	2.2	153	3.7
34	3 38.5	3 39.1	3 28.5	34	0.8	94	2.3	154	3.7
35	3 38.8	3 39.3	3 28.8	35	0.8	95	2.3	155	3.7
36	3 39.0	3 39.6	3 29.0	36	0.9	96	2.3	156	3.8
37	3 39.3	3 39.9	3 29.3	37	0.9	97	2.3	157	3.8
38	3 39.5	3 40.1	3 29.5	38	0.9	98	2.4	158	3.8
39	3 39.8	3 40.4	3 29.7	39	0.9	99	2.4	159	3.8
40	3 40.0	3 40.6	3 30.0	40	1.0	100	2.4	160	3.9
41	3 40.3	3 40.9	3 30.2	41	1.0	101	2.4	161	3.9
42	3 40.5	3 41.1	3 30.5	42	1.0	102	2.5	162	3.9
43	3 40.8	3 41.4	3 30.7	43	1.0	103	2.5	163	3.9
44	3 41.0	3 41.6	3 30.9	44	1.1	104	2.5	164	4.0
45	3 41.3	3 41.9	3 31.2	45	1.1	105	2.5	165	4.0
46	3 41.5	3 42.1	3 31.4	46	1.1	106	2.6	166	4.0
47	3 41.8	3 42.4	3 31.6	47	1.1	107	2.6	167	4.0
48	3 42.0	3 42.6	3 31.9	48	1.2	108	2.6	168	4.1
49	3 42.3	3 42.9	3 32.1	49	1.2	109	2.6	169	4.1
50	3 42.5	3 43.1	3 32.4	50	1.2	110	2.7	170	4.1
51	3 42.8	3 43.4	3 32.6	51	1.2	111	2.7	171	4.1
52	3 43.0	3 43.6	3 32.8	52	1.3	112	2.7	172	4.2
53	3 43.3	3 43.9	3 33.1	53	1.3	113	2.7	173	4.2
54	3 43.5	3 44.1	3 33.3	54	1.3	114	2.8	174	4.2
55	3 43.8	3 44.4	3 33.6	55	1.3	115	2.8	175	4.2
56	3 44.0	3 44.6	3 33.8	56	1.4	116	2.8	176	4.3
57	3 44.3	3 44.9	3 34.0	57	1.4	117	2.8	177	4.3
58	3 44.5	3 45.1	3 34.3	58	1.4	118	2.9	178	4.3
59	3 44.8	3 45.4	3 34.5	59	1.4	119	2.9	179	4.3
60	3 45.0	3 45.6	3 34.8	60	1.5	120	2.9	180	4.4

15m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	3 45.0	3 45.6	3 34.8	0	0.0	60	1.6	120	3.1
1	3 45.3	3 45.9	3 35.0	1	0.0	61	1.6	121	3.1
2	3 45.5	3 46.1	3 35.2	2	0.1	62	1.6	122	3.2
3	3 45.8	3 46.4	3 35.5	3	0.1	63	1.6	123	3.2
4	3 46.0	3 46.6	3 35.7	4	0.1	64	1.7	124	3.2
5	3 46.3	3 46.9	3 35.9	5	0.1	65	1.7	125	3.2
6	3 46.5	3 47.1	3 36.2	6	0.2	66	1.7	126	3.3
7	3 46.8	3 47.4	3 36.4	7	0.2	67	1.7	127	3.3
8	3 47.0	3 47.6	3 36.7	8	0.2	68	1.8	128	3.3
9	3 47.3	3 47.9	3 36.9	9	0.2	69	1.8	129	3.3
10	3 47.5	3 48.1	3 37.1	10	0.3	70	1.8	130	3.4
11	3 47.8	3 48.4	3 37.4	11	0.3	71	1.8	131	3.4
12	3 48.0	3 48.6	3 37.6	12	0.3	72	1.9	132	3.4
13	3 48.3	3 48.9	3 37.9	13	0.3	73	1.9	133	3.4
14	3 48.5	3 49.1	3 38.1	14	0.4	74	1.9	134	3.5
15	3 48.8	3 49.4	3 38.3	15	0.4	75	1.9	135	3.5
16	3 49.0	3 49.6	3 38.6	16	0.4	76	2.0	136	3.5
17	3 49.3	3 49.9	3 38.8	17	0.4	77	2.0	137	3.5
18	3 49.5	3 50.1	3 39.0	18	0.5	78	2.0	138	3.6
19	3 49.8	3 50.4	3 39.3	19	0.5	79	2.0	139	3.6
20	3 50.0	3 50.6	3 39.5	20	0.5	80	2.1	140	3.6
21	3 50.3	3 50.9	3 39.8	21	0.5	81	2.1	141	3.6
22	3 50.5	3 51.1	3 40.0	22	0.6	82	2.1	142	3.7
23	3 50.8	3 51.4	3 40.2	23	0.6	83	2.1	143	3.7
24	3 51.0	3 51.6	3 40.5	24	0.6	84	2.2	144	3.7
25	3 51.3	3 51.9	3 40.7	25	0.6	85	2.2	145	3.7
26	3 51.5	3 52.1	3 41.0	26	0.7	86	2.2	146	3.8
27	3 51.8	3 52.4	3 41.2	27	0.7	87	2.2	147	3.8
28	3 52.0	3 52.6	3 41.4	28	0.7	88	2.3	148	3.8
29	3 52.3	3 52.9	3 41.7	29	0.7	89	2.3	149	3.8
30	3 52.5	3 53.1	3 41.9	30	0.8	90	2.3	150	3.9
31	3 52.8	3 53.4	3 42.1	31	0.8	91	2.4	151	3.9
32	3 53.0	3 53.6	3 42.4	32	0.8	92	2.4	152	3.9
33	3 53.3	3 53.9	3 42.6	33	0.9	93	2.4	153	4.0
34	3 53.5	3 54.1	3 42.9	34	0.9	94	2.4	154	4.0
35	3 53.8	3 54.4	3 43.1	35	0.9	95	2.5	155	4.0
36	3 54.0	3 54.6	3 43.3	36	0.9	96	2.5	156	4.0
37	3 54.3	3 54.9	3 43.6	37	1.0	97	2.5	157	4.1
38	3 54.5	3 55.1	3 43.8	38	1.0	98	2.5	158	4.1
39	3 54.8	3 55.4	3 44.1	39	1.0	99	2.6	159	4.1
40	3 55.0	3 55.6	3 44.3	40	1.0	100	2.6	160	4.1
41	3 55.3	3 55.9	3 44.5	41	1.1	101	2.6	161	4.2
42	3 55.5	3 56.1	3 44.8	42	1.1	102	2.6	162	4.2
43	3 55.8	3 56.4	3 45.0	43	1.1	103	2.7	163	4.2
44	3 56.0	3 56.6	3 45.2	44	1.1	104	2.7	164	4.2
45	3 56.3	3 56.9	3 45.5	45	1.2	105	2.7	165	4.3
46	3 56.5	3 57.1	3 45.7	46	1.2	106	2.7	166	4.3
47	3 56.8	3 57.4	3 46.0	47	1.2	107	2.8	167	4.3
48	3 57.0	3 57.6	3 46.2	48	1.2	108	2.8	168	4.3
49	3 57.3	3 57.9	3 46.4	49	1.3	109	2.8	169	4.4
50	3 57.5	3 58.2	3 46.7	50	1.3	110	2.8	170	4.4
51	3 57.8	3 58.4	3 46.9	51	1.3	111	2.9	171	4.4
52	3 58.0	3 58.7	3 47.2	52	1.3	112	2.9	172	4.4
53	3 58.3	3 58.9	3 47.4	53	1.4	113	2.9	173	4.5
54	3 58.5	3 59.2	3 47.6	54	1.4	114	2.9	174	4.5
55	3 58.8	3 59.4	3 47.9	55	1.4	115	3.0	175	4.5
56	3 59.0	3 59.7	3 48.1	56	1.4	116	3.0	176	4.5
57	3 59.3	3 59.9	3 48.4	57	1.5	117	3.0	177	4.6
58	3 59.5	4 00.2	3 48.6	58	1.5	118	3.0	178	4.6
59	3 59.8	4 00.4	3 48.8	59	1.5	119	3.1	179	4.6
60	4 00.0	4 00.7	3 49.1	60	1.6	120	3.1	180	4.7

16m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	4 00.0	4 00.7	3 49.1	0	0.0	60	1.7	120	3.3
1	4 00.3	4 00.9	3 49.3	1	0.0	61	1.7	121	3.3
2	4 00.5	4 01.2	3 49.5	2	0.1	62	1.7	122	3.4
3	4 00.8	4 01.4	3 49.8	3	0.1	63	1.7	123	3.4
4	4 01.0	4 01.7	3 50.0	4	0.1	64	1.8	124	3.4
5	4 01.3	4 01.9	3 50.3	5	0.1	65	1.8	125	3.4
6	4 01.5	4 02.2	3 50.5	6	0.2	66	1.8	126	3.5
7	4 01.8	4 02.4	3 50.7	7	0.2	67	1.8	127	3.5
8	4 02.0	4 02.7	3 51.0	8	0.2	68	1.9	128	3.5
9	4 02.3	4 02.9	3 51.2	9	0.2	69	1.9	129	3.5
10	4 02.5	4 03.2	3 51.5	10	0.3	70	1.9	130	3.6
11	4 02.8	4 03.4	3 51.7	11	0.3	71	2.0	131	3.6
12	4 03.0	4 03.7	3 51.9	12	0.3	72	2.0	132	3.6
13	4 03.3	4 03.9	3 52.2	13	0.4	73	2.0	133	3.7
14	4 03.5	4 04.2	3 52.4	14	0.4	74	2.0	134	3.7
15	4 03.8	4 04.4	3 52.6	15	0.4	75	2.1	135	3.7
16	4 04.0	4 04.7	3 52.9	16	0.4	76	2.1	136	3.7
17	4 04.3	4 04.9	3 53.1	17	0.5	77	2.1	137	3.8
18	4 04.5	4 05.2	3 53.4	18	0.5	78	2.1	138	3.8
19	4 04.8	4 05.4	3 53.6	19	0.5	79	2.2	139	3.8
20	4 05.0	4 05.7	3 53.8	20	0.6	80	2.2	140	3.9
21	4 05.3	4 05.9	3 54.1	21	0.6	81	2.2	141	3.9
22	4 05.5	4 06.2	3 54.3	22	0.6	82	2.3	142	3.9
23	4 05.8	4 06.4	3 54.6	23	0.6	83	2.3	143	3.9
24	4 06.0	4 06.7	3 54.8	24	0.7	84	2.3	144	4.0
25	4 06.3	4 06.9	3 55.0	25	0.7	85	2.3	145	4.0
26	4 06.5	4 07.2	3 55.3	26	0.7	86	2.4	146	4.0
27	4 06.8	4 07.4	3 55.5	27	0.7	87	2.4	147	4.0
28	4 07.0	4 07.7	3 55.7	28	0.8	88	2.4	148	4.1
29	4 07.3	4 07.9	3 56.0	29	0.8	89	2.4	149	4.1
30	4 07.5	4 08.2	3 56.2	30	0.8	90	2.5	150	4.1
31	4 07.8	4 08.4	3 56.5	31	0.9	91	2.5	151	4.2
32	4 08.0	4 08.7	3 56.7	32	0.9	92	2.5	152	4.2
33	4 08.3	4 08.9	3 56.9	33	0.9	93	2.6	153	4.2
34	4 08.5	4 09.2	3 57.2	34	0.9	94	2.6	154	4.2
35	4 08.8	4 09.4	3 57.4	35	1.0	95	2.6	155	4.3
36	4 09.0	4 09.7	3 57.7	36	1.0	96	2.6	156	4.3
37	4 09.3	4 09.9	3 57.9	37	1.0	97	2.7	157	4.3
38	4 09.5	4 10.2	3 58.1	38	1.0	98	2.7	158	4.3
39	4 09.8	4 10.4	3 58.4	39	1.1	99	2.7	159	4.4
40	4 10.0	4 10.7	3 58.6	40	1.1	100	2.8	160	4.4
41	4 10.3	4 10.9	3 58.8	41	1.1	101	2.8	161	4.4
42	4 10.5	4 11.2	3 59.1	42	1.2	102	2.8	162	4.5
43	4 10.8	4 11.4	3 59.3	43	1.2	103	2.8	163	4.5
44	4 11.0	4 11.7	3 59.6	44	1.2	104	2.9	164	4.5
45	4 11.3	4 11.9	3 59.8	45	1.2	105	2.9	165	4.5
46	4 11.5	4 12.2	4 00.0	46	1.3	106	2.9	166	4.6
47	4 11.8	4 12.4	4 00.3	47	1.3	107	2.9	167	4.6
48	4 12.0	4 12.7	4 00.5	48	1.3	108	3.0	168	4.6
49	4 12.3	4 12.9	4 00.8	49	1.3	109	3.0	169	4.6
50	4 12.5	4 13.2	4 01.0	50	1.4	110	3.0	170	4.7
51	4 12.8	4 13.4	4 01.2	51	1.4	111	3.1	171	4.7
52	4 13.0	4 13.7	4 01.5	52	1.4	112	3.1	172	4.7
53	4 13.3	4 13.9	4 01.7	53	1.5	113	3.1	173	4.8
54	4 13.5	4 14.2	4 02.0	54	1.5	114	3.1	174	4.8
55	4 13.8	4 14.4	4 02.2	55	1.5	115	3.2	175	4.8
56	4 14.0	4 14.7	4 02.4	56	1.5	116	3.2	176	4.8
57	4 14.3	4 14.9	4 02.7	57	1.6	117	3.2	177	4.9
58	4 14.5	4 15.2	4 02.9	58	1.6	118	3.2	178	4.9
59	4 14.8	4 15.4	4 03.1	59	1.6	119	3.3	179	4.9
60	4 15.0	4 15.7	4 03.4	60	1.7	120	3.3	180	5.0

17m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	4 15.0	4 15.7	4 03.4	0	0.0	60	1.8	120	3.5
1	4 15.3	4 15.9	4 03.6	1	0.0	61	1.8	121	3.5
2	4 15.5	4 16.2	4 03.9	2	0.1	62	1.8	122	3.6
3	4 15.8	4 16.5	4 04.1	3	0.1	63	1.8	123	3.6
4	4 16.0	4 16.7	4 04.3	4	0.1	64	1.9	124	3.6
5	4 16.3	4 17.0	4 04.6	5	0.1	65	1.9	125	3.6
6	4 16.5	4 17.2	4 04.8	6	0.2	66	1.9	126	3.7
7	4 16.8	4 17.5	4 05.1	7	0.2	67	2.0	127	3.7
8	4 17.0	4 17.7	4 05.3	8	0.2	68	2.0	128	3.7
9	4 17.3	4 18.0	4 05.5	9	0.3	69	2.0	129	3.8
10	4 17.5	4 18.2	4 05.8	10	0.3	70	2.0	130	3.8
11	4 17.8	4 18.5	4 06.0	11	0.3	71	2.1	131	3.8
12	4 18.0	4 18.7	4 06.2	12	0.4	72	2.1	132	3.9
13	4 18.3	4 19.0	4 06.5	13	0.4	73	2.1	133	3.9
14	4 18.5	4 19.2	4 06.7	14	0.4	74	2.2	134	3.9
15	4 18.8	4 19.5	4 07.0	15	0.4	75	2.2	135	3.9
16	4 19.0	4 19.7	4 07.2	16	0.5	76	2.2	136	4.0
17	4 19.3	4 20.0	4 07.4	17	0.5	77	2.2	137	4.0
18	4 19.5	4 20.2	4 07.7	18	0.5	78	2.3	138	4.0
19	4 19.8	4 20.5	4 07.9	19	0.6	79	2.3	139	4.1
20	4 20.0	4 20.7	4 08.2	20	0.6	80	2.3	140	4.1
21	4 20.3	4 21.0	4 08.4	21	0.6	81	2.4	141	4.1
22	4 20.5	4 21.2	4 08.6	22	0.6	82	2.4	142	4.1
23	4 20.8	4 21.5	4 08.9	23	0.7	83	2.4	143	4.2
24	4 21.0	4 21.7	4 09.1	24	0.7	84	2.5	144	4.2
25	4 21.3	4 22.0	4 09.3	25	0.7	85	2.5	145	4.2
26	4 21.5	4 22.2	4 09.6	26	0.8	86	2.5	146	4.3
27	4 21.8	4 22.5	4 09.8	27	0.8	87	2.5	147	4.3
28	4 22.0	4 22.7	4 10.1	28	0.8	88	2.6	148	4.3
29	4 22.3	4 23.0	4 10.3	29	0.8	89	2.6	149	4.3
30	4 22.5	4 23.2	4 10.5	30	0.9	90	2.6	150	4.4
31	4 22.8	4 23.5	4 10.8	31	0.9	91	2.7	151	4.4
32	4 23.0	4 23.7	4 11.0	32	0.9	92	2.7	152	4.4
33	4 23.3	4 24.0	4 11.3	33	1.0	93	2.7	153	4.5
34	4 23.5	4 24.2	4 11.5	34	1.0	94	2.7	154	4.5
35	4 23.8	4 24.5	4 11.7	35	1.0	95	2.8	155	4.5
36	4 24.0	4 24.7	4 12.0	36	1.1	96	2.8	156	4.6
37	4 24.3	4 25.0	4 12.2	37	1.1	97	2.8	157	4.6
38	4 24.5	4 25.2	4 12.5	38	1.1	98	2.9	158	4.6
39	4 24.8	4 25.5	4 12.7	39	1.1	99	2.9	159	4.6
40	4 25.0	4 25.7	4 12.9	40	1.2	100	2.9	160	4.7
41	4 25.3	4 26.0	4 13.2	41	1.2	101	2.9	161	4.7
42	4 25.5	4 26.2	4 13.4	42	1.2	102	3.0	162	4.7
43	4 25.8	4 26.5	4 13.6	43	1.3	103	3.0	163	4.8
44	4 26.0	4 26.7	4 13.9	44	1.3	104	3.0	164	4.8
45	4 26.3	4 27.0	4 14.1	45	1.3	105	3.1	165	4.8
46	4 26.5	4 27.2	4 14.4	46	1.3	106	3.1	166	4.8
47	4 26.8	4 27.5	4 14.6	47	1.4	107	3.1	167	4.9
48	4 27.0	4 27.7	4 14.8	48	1.4	108	3.2	168	4.9
49	4 27.3	4 28.0	4 15.1	49	1.4	109	3.2	169	4.9
50	4 27.5	4 28.2	4 15.3	50	1.5	110	3.2	170	5.0
51	4 27.8	4 28.5	4 15.6	51	1.5	111	3.2	171	5.0
52	4 28.0	4 28.7	4 15.8	52	1.5	112	3.3	172	5.0
53	4 28.3	4 29.0	4 16.0	53	1.5	113	3.3	173	5.0
54	4 28.5	4 29.2	4 16.3	54	1.6	114	3.3	174	5.1
55	4 28.8	4 29.5	4 16.5	55	1.6	115	3.4	175	5.1
56	4 29.0	4 29.7	4 16.7	56	1.6	116	3.4	176	5.1
57	4 29.3	4 30.0	4 17.0	57	1.7	117	3.4	177	5.2
58	4 29.5	4 30.2	4 17.2	58	1.7	118	3.4	178	5.2
59	4 29.8	4 30.5	4 17.5	59	1.7	119	3.5	179	5.2
60	4 30.0	4 30.7	4 17.7	60	1.8	120	3.5	180	5.3

18m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	4 30.0	4 30.7	4 17.7	0	0.0	60	1.9	120	3.7
1	4 30.3	4 31.0	4 17.9	1	0.0	61	1.9	121	3.7
2	4 30.5	4 31.2	4 18.2	2	0.1	62	1.9	122	3.8
3	4 30.8	4 31.5	4 18.4	3	0.1	63	1.9	123	3.8
4	4 31.0	4 31.7	4 18.7	4	0.1	64	2.0	124	3.8
5	4 31.3	4 32.0	4 18.9	5	0.2	65	2.0	125	3.9
6	4 31.5	4 32.2	4 19.1	6	0.2	66	2.0	126	3.9
7	4 31.8	4 32.5	4 19.4	7	0.2	67	2.1	127	3.9
8	4 32.0	4 32.7	4 19.6	8	0.2	68	2.1	128	3.9
9	4 32.3	4 33.0	4 19.8	9	0.3	69	2.1	129	4.0
10	4 32.5	4 33.2	4 20.1	10	0.3	70	2.2	130	4.0
11	4 32.8	4 33.5	4 20.3	11	0.3	71	2.2	131	4.0
12	4 33.0	4 33.7	4 20.6	12	0.4	72	2.2	132	4.1
13	4 33.3	4 34.0	4 20.8	13	0.4	73	2.3	133	4.1
14	4 33.5	4 34.2	4 21.0	14	0.4	74	2.3	134	4.1
15	4 33.8	4 34.5	4 21.3	15	0.5	75	2.3	135	4.2
16	4 34.0	4 34.8	4 21.5	16	0.5	76	2.3	136	4.2
17	4 34.3	4 35.0	4 21.8	17	0.5	77	2.4	137	4.2
18	4 34.5	4 35.3	4 22.0	18	0.6	78	2.4	138	4.3
19	4 34.8	4 35.5	4 22.2	19	0.6	79	2.4	139	4.3
20	4 35.0	4 35.8	4 22.5	20	0.6	80	2.5	140	4.3
21	4 35.3	4 36.0	4 22.7	21	0.6	81	2.5	141	4.3
22	4 35.5	4 36.3	4 22.9	22	0.7	82	2.5	142	4.4
23	4 35.8	4 36.5	4 23.2	23	0.7	83	2.6	143	4.4
24	4 36.0	4 36.8	4 23.4	24	0.7	84	2.6	144	4.4
25	4 36.3	4 37.0	4 23.7	25	0.8	85	2.6	145	4.5
26	4 36.5	4 37.3	4 23.9	26	0.8	86	2.7	146	4.5
27	4 36.8	4 37.5	4 24.1	27	0.8	87	2.7	147	4.5
28	4 37.0	4 37.8	4 24.4	28	0.9	88	2.7	148	4.6
29	4 37.3	4 38.0	4 24.6	29	0.9	89	2.7	149	4.6
30	4 37.5	4 38.3	4 24.9	30	0.9	90	2.8	150	4.6
31	4 37.8	4 38.5	4 25.1	31	1.0	91	2.8	151	4.7
32	4 38.0	4 38.8	4 25.3	32	1.0	92	2.8	152	4.7
33	4 38.3	4 39.0	4 25.6	33	1.0	93	2.9	153	4.7
34	4 38.5	4 39.3	4 25.8	34	1.0	94	2.9	154	4.7
35	4 38.8	4 39.5	4 26.1	35	1.1	95	2.9	155	4.8
36	4 39.0	4 39.8	4 26.3	36	1.1	96	3.0	156	4.8
37	4 39.3	4 40.0	4 26.5	37	1.1	97	3.0	157	4.8
38	4 39.5	4 40.3	4 26.8	38	1.2	98	3.0	158	4.9
39	4 39.8	4 40.5	4 27.0	39	1.2	99	3.1	159	4.9
40	4 40.0	4 40.8	4 27.2	40	1.2	100	3.1	160	4.9
41	4 40.3	4 41.0	4 27.5	41	1.3	101	3.1	161	5.0
42	4 40.5	4 41.3	4 27.7	42	1.3	102	3.1	162	5.0
43	4 40.8	4 41.5	4 28.0	43	1.3	103	3.2	163	5.0
44	4 41.0	4 41.8	4 28.2	44	1.4	104	3.2	164	5.1
45	4 41.3	4 42.0	4 28.4	45	1.4	105	3.2	165	5.1
46	4 41.5	4 42.3	4 28.7	46	1.4	106	3.3	166	5.1
47	4 41.8	4 42.5	4 28.9	47	1.4	107	3.3	167	5.1
48	4 42.0	4 42.8	4 29.2	48	1.5	108	3.3	168	5.2
49	4 42.3	4 43.0	4 29.4	49	1.5	109	3.4	169	5.2
50	4 42.5	4 43.3	4 29.6	50	1.5	110	3.4	170	5.2
51	4 42.8	4 43.5	4 29.9	51	1.6	111	3.4	171	5.3
52	4 43.0	4 43.8	4 30.1	52	1.6	112	3.5	172	5.3
53	4 43.3	4 44.0	4 30.3	53	1.6	113	3.5	173	5.3
54	4 43.5	4 44.3	4 30.6	54	1.7	114	3.5	174	5.4
55	4 43.8	4 44.5	4 30.8	55	1.7	115	3.5	175	5.4
56	4 44.0	4 44.8	4 31.1	56	1.7	116	3.6	176	5.4
57	4 44.3	4 45.0	4 31.3	57	1.8	117	3.6	177	5.5
58	4 44.5	4 45.3	4 31.5	58	1.8	118	3.6	178	5.5
59	4 44.8	4 45.5	4 31.8	59	1.8	119	3.7	179	5.5
60	4 45.0	4 45.8	4 32.0	60	1.9	120	3.7	180	5.6

19m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	4 45.0	4 45.8	4 32.0	0	0.0	60	2.0	120	3.9
1	4 45.3	4 46.0	4 32.3	1	0.0	61	2.0	121	3.9
2	4 45.5	4 46.3	4 32.5	2	0.1	62	2.0	122	4.0
3	4 45.8	4 46.5	4 32.7	3	0.1	63	2.0	123	4.0
4	4 46.0	4 46.8	4 33.0	4	0.1	64	2.1	124	4.0
5	4 46.3	4 47.0	4 33.2	5	0.2	65	2.1	125	4.1
6	4 46.5	4 47.3	4 33.4	6	0.2	66	2.1	126	4.1
7	4 46.8	4 47.5	4 33.7	7	0.2	67	2.2	127	4.1
8	4 47.0	4 47.8	4 33.9	8	0.3	68	2.2	128	4.2
9	4 47.3	4 48.0	4 34.2	9	0.3	69	2.2	129	4.2
10	4 47.5	4 48.3	4 34.4	10	0.3	70	2.3	130	4.2
11	4 47.8	4 48.5	4 34.6	11	0.4	71	2.3	131	4.3
12	4 48.0	4 48.8	4 34.9	12	0.4	72	2.3	132	4.3
13	4 48.3	4 49.0	4 35.1	13	0.4	73	2.4	133	4.3
14	4 48.5	4 49.3	4 35.4	14	0.5	74	2.4	134	4.4
15	4 48.8	4 49.5	4 35.6	15	0.5	75	2.4	135	4.4
16	4 49.0	4 49.8	4 35.8	16	0.5	76	2.5	136	4.4
17	4 49.3	4 50.0	4 36.1	17	0.6	77	2.5	137	4.5
18	4 49.5	4 50.3	4 36.3	18	0.6	78	2.5	138	4.5
19	4 49.8	4 50.5	4 36.6	19	0.6	79	2.6	139	4.5
20	4 50.0	4 50.8	4 36.8	20	0.7	80	2.6	140	4.6
21	4 50.3	4 51.0	4 37.0	21	0.7	81	2.6	141	4.6
22	4 50.5	4 51.3	4 37.3	22	0.7	82	2.7	142	4.6
23	4 50.8	4 51.5	4 37.5	23	0.7	83	2.7	143	4.6
24	4 51.0	4 51.8	4 37.7	24	0.8	84	2.7	144	4.7
25	4 51.3	4 52.0	4 38.0	25	0.8	85	2.8	145	4.7
26	4 51.5	4 52.3	4 38.2	26	0.8	86	2.8	146	4.7
27	4 51.8	4 52.5	4 38.5	27	0.9	87	2.8	147	4.8
28	4 52.0	4 52.8	4 38.7	28	0.9	88	2.9	148	4.8
29	4 52.3	4 53.1	4 38.9	29	0.9	89	2.9	149	4.8
30	4 52.5	4 53.3	4 39.2	30	1.0	90	2.9	150	4.9
31	4 52.8	4 53.6	4 39.4	31	1.0	91	3.0	151	4.9
32	4 53.0	4 53.8	4 39.7	32	1.0	92	3.0	152	4.9
33	4 53.3	4 54.1	4 39.9	33	1.1	93	3.0	153	5.0
34	4 53.5	4 54.3	4 40.1	34	1.1	94	3.1	154	5.0
35	4 53.8	4 54.6	4 40.4	35	1.1	95	3.1	155	5.0
36	4 54.0	4 54.8	4 40.6	36	1.2	96	3.1	156	5.1
37	4 54.3	4 55.1	4 40.8	37	1.2	97	3.2	157	5.1
38	4 54.5	4 55.3	4 41.1	38	1.2	98	3.2	158	5.1
39	4 54.8	4 55.6	4 41.3	39	1.3	99	3.2	159	5.2
40	4 55.0	4 55.8	4 41.6	40	1.3	100	3.3	160	5.2
41	4 55.3	4 56.1	4 41.8	41	1.3	101	3.3	161	5.2
42	4 55.5	4 56.3	4 42.0	42	1.4	102	3.3	162	5.3
43	4 55.8	4 56.6	4 42.3	43	1.4	103	3.3	163	5.3
44	4 56.0	4 56.8	4 42.5	44	1.4	104	3.4	164	5.3
45	4 56.3	4 57.1	4 42.8	45	1.5	105	3.4	165	5.4
46	4 56.5	4 57.3	4 43.0	46	1.5	106	3.4	166	5.4
47	4 56.8	4 57.6	4 43.2	47	1.5	107	3.5	167	5.4
48	4 57.0	4 57.8	4 43.5	48	1.6	108	3.5	168	5.5
49	4 57.3	4 58.1	4 43.7	49	1.6	109	3.5	169	5.5
50	4 57.5	4 58.3	4 43.9	50	1.6	110	3.6	170	5.5
51	4 57.8	4 58.6	4 44.2	51	1.7	111	3.6	171	5.6
52	4 58.0	4 58.8	4 44.4	52	1.7	112	3.6	172	5.6
53	4 58.3	4 59.1	4 44.7	53	1.7	113	3.7	173	5.6
54	4 58.5	4 59.3	4 44.9	54	1.8	114	3.7	174	5.7
55	4 58.8	4 59.6	4 45.1	55	1.8	115	3.7	175	5.7
56	4 59.0	4 59.8	4 45.4	56	1.8	116	3.8	176	5.7
57	4 59.3	5 00.1	4 45.6	57	1.9	117	3.8	177	5.8
58	4 59.5	5 00.3	4 45.9	58	1.9	118	3.8	178	5.8
59	4 59.8	5 00.6	4 46.1	59	1.9	119	3.9	179	5.8
60	5 00.0	5 00.8	4 46.3	60	2.0	120	3.9	180	5.9

20m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	5 00.0	5 00.8	4 46.3	0	0.0	60	2.1	120	4.1
1	5 00.3	5 01.1	4 46.6	1	0.0	61	2.1	121	4.1
2	5 00.5	5 01.3	4 46.8	2	0.1	62	2.1	122	4.2
3	5 00.8	5 01.6	4 47.0	3	0.1	63	2.2	123	4.2
4	5 01.0	5 01.8	4 47.3	4	0.1	64	2.2	124	4.2
5	5 01.3	5 02.1	4 47.5	5	0.2	65	2.2	125	4.3
6	5 01.5	5 02.3	4 47.8	6	0.2	66	2.3	126	4.3
7	5 01.8	5 02.6	4 48.0	7	0.2	67	2.3	127	4.3
8	5 02.0	5 02.8	4 48.2	8	0.3	68	2.3	128	4.4
9	5 02.3	5 03.1	4 48.5	9	0.3	69	2.4	129	4.4
10	5 02.5	5 03.3	4 48.7	10	0.3	70	2.4	130	4.4
11	5 02.8	5 03.6	4 49.0	11	0.4	71	2.4	131	4.5
12	5 03.0	5 03.8	4 49.2	12	0.4	72	2.5	132	4.5
13	5 03.3	5 04.1	4 49.4	13	0.4	73	2.5	133	4.5
14	5 03.5	5 04.3	4 49.7	14	0.5	74	2.5	134	4.6
15	5 03.8	5 04.6	4 49.9	15	0.5	75	2.6	135	4.6
16	5 04.0	5 04.8	4 50.2	16	0.5	76	2.6	136	4.6
17	5 04.3	5 05.1	4 50.4	17	0.6	77	2.6	137	4.7
18	5 04.5	5 05.3	4 50.6	18	0.6	78	2.7	138	4.7
19	5 04.8	5 05.6	4 50.9	19	0.6	79	2.7	139	4.7
20	5 05.0	5 05.8	4 51.1	20	0.7	80	2.7	140	4.8
21	5 05.3	5 06.1	4 51.3	21	0.7	81	2.8	141	4.8
22	5 05.5	5 06.3	4 51.6	22	0.8	82	2.8	142	4.9
23	5 05.8	5 06.6	4 51.8	23	0.8	83	2.8	143	4.9
24	5 06.0	5 06.8	4 52.1	24	0.8	84	2.9	144	4.9
25	5 06.3	5 07.1	4 52.3	25	0.9	85	2.9	145	5.0
26	5 06.5	5 07.3	4 52.5	26	0.9	86	2.9	146	5.0
27	5 06.8	5 07.6	4 52.8	27	0.9	87	3.0	147	5.0
28	5 07.0	5 07.8	4 53.0	28	1.0	88	3.0	148	5.1
29	5 07.3	5 08.1	4 53.3	29	1.0	89	3.0	149	5.1
30	5 07.5	5 08.3	4 53.5	30	1.0	90	3.1	150	5.1
31	5 07.8	5 08.6	4 53.7	31	1.1	91	3.1	151	5.2
32	5 08.0	5 08.8	4 54.0	32	1.1	92	3.1	152	5.2
33	5 08.3	5 09.1	4 54.2	33	1.1	93	3.2	153	5.2
34	5 08.5	5 09.3	4 54.4	34	1.2	94	3.2	154	5.3
35	5 08.8	5 09.6	4 54.7	35	1.2	95	3.2	155	5.3
36	5 09.0	5 09.8	4 54.9	36	1.2	96	3.3	156	5.3
37	5 09.3	5 10.1	4 55.2	37	1.3	97	3.3	157	5.4
38	5 09.5	5 10.3	4 55.4	38	1.3	98	3.3	158	5.4
39	5 09.8	5 10.6	4 55.6	39	1.3	99	3.4	159	5.4
40	5 10.0	5 10.8	4 55.9	40	1.4	100	3.4	160	5.5
41	5 10.3	5 11.1	4 56.1	41	1.4	101	3.5	161	5.5
42	5 10.5	5 11.4	4 56.4	42	1.4	102	3.5	162	5.5
43	5 10.8	5 11.6	4 56.6	43	1.5	103	3.5	163	5.6
44	5 11.0	5 11.9	4 56.8	44	1.5	104	3.6	164	5.6
45	5 11.3	5 12.1	4 57.1	45	1.5	105	3.6	165	5.6
46	5 11.5	5 12.4	4 57.3	46	1.6	106	3.6	166	5.7
47	5 11.8	5 12.6	4 57.5	47	1.6	107	3.7	167	5.7
48	5 12.0	5 12.9	4 57.8	48	1.6	108	3.7	168	5.7
49	5 12.3	5 13.1	4 58.0	49	1.7	109	3.7	169	5.8
50	5 12.5	5 13.4	4 58.3	50	1.7	110	3.8	170	5.8
51	5 12.8	5 13.6	4 58.5	51	1.7	111	3.8	171	5.8
52	5 13.0	5 13.9	4 58.7	52	1.8	112	3.8	172	5.9
53	5 13.3	5 14.1	4 59.0	53	1.8	113	3.9	173	5.9
54	5 13.5	5 14.4	4 59.2	54	1.8	114	3.9	174	5.9
55	5 13.8	5 14.6	4 59.5	55	1.9	115	3.9	175	6.0
56	5 14.0	5 14.9	4 59.7	56	1.9	116	4.0	176	6.0
57	5 14.3	5 15.1	4 59.9	57	1.9	117	4.0	177	6.0
58	5 14.5	5 15.4	5 00.2	58	2.0	118	4.0	178	6.1
59	5 14.8	5 15.6	5 00.4	59	2.0	119	4.1	179	6.1
60	5 15.0	5 15.9	5 00.7	60	2.1	120	4.1	180	6.2

21m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	5 15.0	5 15.9	5 00.7	0	0.0	60	2.2	120	4.3
1	5 15.3	5 16.1	5 00.9	1	0.0	61	2.2	121	4.3
2	5 15.5	5 16.4	5 01.1	2	0.1	62	2.2	122	4.4
3	5 15.8	5 16.6	5 01.4	3	0.1	63	2.3	123	4.4
4	5 16.0	5 16.9	5 01.6	4	0.1	64	2.3	124	4.4
5	5 16.3	5 17.1	5 01.8	5	0.2	65	2.3	125	4.5
6	5 16.5	5 17.4	5 02.1	6	0.2	66	2.4	126	4.5
7	5 16.8	5 17.6	5 02.3	7	0.3	67	2.4	127	4.6
8	5 17.0	5 17.9	5 02.6	8	0.3	68	2.4	128	4.6
9	5 17.3	5 18.1	5 02.8	9	0.3	69	2.5	129	4.6
10	5 17.5	5 18.4	5 03.0	10	0.4	70	2.5	130	4.7
11	5 17.8	5 18.6	5 03.3	11	0.4	71	2.5	131	4.7
12	5 18.0	5 18.9	5 03.5	12	0.4	72	2.6	132	4.7
13	5 18.3	5 19.1	5 03.8	13	0.5	73	2.6	133	4.8
14	5 18.5	5 19.4	5 04.0	14	0.5	74	2.7	134	4.8
15	5 18.8	5 19.6	5 04.2	15	0.5	75	2.7	135	4.8
16	5 19.0	5 19.9	5 04.5	16	0.6	76	2.7	136	4.9
17	5 19.3	5 20.1	5 04.7	17	0.6	77	2.8	137	4.9
18	5 19.5	5 20.4	5 04.9	18	0.6	78	2.8	138	4.9
19	5 19.8	5 20.6	5 05.2	19	0.7	79	2.8	139	5.0
20	5 20.0	5 20.9	5 05.4	20	0.7	80	2.9	140	5.0
21	5 20.3	5 21.1	5 05.7	21	0.8	81	2.9	141	5.1
22	5 20.5	5 21.4	5 05.9	22	0.8	82	2.9	142	5.1
23	5 20.8	5 21.6	5 06.1	23	0.8	83	3.0	143	5.1
24	5 21.0	5 21.9	5 06.4	24	0.9	84	3.0	144	5.2
25	5 21.3	5 22.1	5 06.6	25	0.9	85	3.0	145	5.2
26	5 21.5	5 22.4	5 06.9	26	0.9	86	3.1	146	5.2
27	5 21.8	5 22.6	5 07.1	27	1.0	87	3.1	147	5.3
28	5 22.0	5 22.9	5 07.3	28	1.0	88	3.2	148	5.3
29	5 22.3	5 23.1	5 07.6	29	1.0	89	3.2	149	5.3
30	5 22.5	5 23.4	5 07.8	30	1.1	90	3.2	150	5.4
31	5 22.8	5 23.6	5 08.0	31	1.1	91	3.3	151	5.4
32	5 23.0	5 23.9	5 08.3	32	1.1	92	3.3	152	5.4
33	5 23.3	5 24.1	5 08.5	33	1.2	93	3.3	153	5.5
34	5 23.5	5 24.4	5 08.8	34	1.2	94	3.4	154	5.5
35	5 23.8	5 24.6	5 09.0	35	1.3	95	3.4	155	5.6
36	5 24.0	5 24.9	5 09.2	36	1.3	96	3.4	156	5.6
37	5 24.3	5 25.1	5 09.5	37	1.3	97	3.5	157	5.6
38	5 24.5	5 25.4	5 09.7	38	1.4	98	3.5	158	5.7
39	5 24.8	5 25.6	5 10.0	39	1.4	99	3.5	159	5.7
40	5 25.0	5 25.9	5 10.2	40	1.4	100	3.6	160	5.7
41	5 25.3	5 26.1	5 10.4	41	1.5	101	3.6	161	5.8
42	5 25.5	5 26.4	5 10.7	42	1.5	102	3.7	162	5.8
43	5 25.8	5 26.6	5 10.9	43	1.5	103	3.7	163	5.8
44	5 26.0	5 26.9	5 11.1	44	1.6	104	3.7	164	5.9
45	5 26.3	5 27.1	5 11.4	45	1.6	105	3.8	165	5.9
46	5 26.5	5 27.4	5 11.6	46	1.6	106	3.8	166	5.9
47	5 26.8	5 27.6	5 11.9	47	1.7	107	3.8	167	6.0
48	5 27.0	5 27.9	5 12.1	48	1.7	108	3.9	168	6.0
49	5 27.3	5 28.1	5 12.3	49	1.8	109	3.9	169	6.1
50	5 27.5	5 28.4	5 12.6	50	1.8	110	3.9	170	6.1
51	5 27.8	5 28.6	5 12.8	51	1.8	111	4.0	171	6.1
52	5 28.0	5 28.9	5 13.1	52	1.9	112	4.0	172	6.2
53	5 28.3	5 29.1	5 13.3	53	1.9	113	4.0	173	6.2
54	5 28.5	5 29.4	5 13.5	54	1.9	114	4.1	174	6.2
55	5 28.8	5 29.7	5 13.8	55	2.0	115	4.1	175	6.3
56	5 29.0	5 29.9	5 14.0	56	2.0	116	4.2	176	6.3
57	5 29.3	5 30.2	5 14.3	57	2.0	117	4.2	177	6.3
58	5 29.5	5 30.4	5 14.5	58	2.1	118	4.2	178	6.4
59	5 29.8	5 30.7	5 14.7	59	2.1	119	4.3	179	6.4
60	5 30.0	5 30.9	5 15.0	60	2.2	120	4.3	180	6.5

22m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	5 30.0	5 30.9	5 15.0	0	0.0	60	2.3	120	4.5
1	5 30.3	5 31.2	5 15.2	1	0.0	61	2.3	121	4.5
2	5 30.5	5 31.4	5 15.4	2	0.1	62	2.3	122	4.6
3	5 30.8	5 31.7	5 15.7	3	0.1	63	2.4	123	4.6
4	5 31.0	5 31.9	5 15.9	4	0.2	64	2.4	124	4.7
5	5 31.3	5 32.2	5 16.2	5	0.2	65	2.4	125	4.7
6	5 31.5	5 32.4	5 16.4	6	0.2	66	2.5	126	4.7
7	5 31.8	5 32.7	5 16.6	7	0.3	67	2.5	127	4.8
8	5 32.0	5 32.9	5 16.9	8	0.3	68	2.6	128	4.8
9	5 32.3	5 33.2	5 17.1	9	0.3	69	2.6	129	4.8
10	5 32.5	5 33.4	5 17.4	10	0.4	70	2.6	130	4.9
11	5 32.8	5 33.7	5 17.6	11	0.4	71	2.7	131	4.9
12	5 33.0	5 33.9	5 17.8	12	0.5	72	2.7	132	5.0
13	5 33.3	5 34.2	5 18.1	13	0.5	73	2.7	133	5.0
14	5 33.5	5 34.4	5 18.3	14	0.5	74	2.8	134	5.0
15	5 33.8	5 34.7	5 18.5	15	0.6	75	2.8	135	5.1
16	5 34.0	5 34.9	5 18.8	16	0.6	76	2.9	136	5.1
17	5 34.3	5 35.2	5 19.0	17	0.6	77	2.9	137	5.1
18	5 34.5	5 35.4	5 19.3	18	0.7	78	2.9	138	5.2
19	5 34.8	5 35.7	5 19.5	19	0.7	79	3.0	139	5.2
20	5 35.0	5 35.9	5 19.7	20	0.8	80	3.0	140	5.3
21	5 35.3	5 36.2	5 20.0	21	0.8	81	3.0	141	5.3
22	5 35.5	5 36.4	5 20.2	22	0.8	82	3.1	142	5.3
23	5 35.8	5 36.7	5 20.5	23	0.9	83	3.1	143	5.4
24	5 36.0	5 36.9	5 20.7	24	0.9	84	3.2	144	5.4
25	5 36.3	5 37.2	5 20.9	25	0.9	85	3.2	145	5.4
26	5 36.5	5 37.4	5 21.2	26	1.0	86	3.2	146	5.5
27	5 36.8	5 37.7	5 21.4	27	1.0	87	3.3	147	5.5
28	5 37.0	5 37.9	5 21.6	28	1.1	88	3.3	148	5.6
29	5 37.3	5 38.2	5 21.9	29	1.1	89	3.3	149	5.6
30	5 37.5	5 38.4	5 22.1	30	1.1	90	3.4	150	5.6
31	5 37.8	5 38.7	5 22.4	31	1.2	91	3.4	151	5.7
32	5 38.0	5 38.9	5 22.6	32	1.2	92	3.5	152	5.7
33	5 38.3	5 39.2	5 22.8	33	1.2	93	3.5	153	5.7
34	5 38.5	5 39.4	5 23.1	34	1.3	94	3.5	154	5.8
35	5 38.8	5 39.7	5 23.3	35	1.3	95	3.6	155	5.8
36	5 39.0	5 39.9	5 23.6	36	1.4	96	3.6	156	5.9
37	5 39.3	5 40.2	5 23.8	37	1.4	97	3.6	157	5.9
38	5 39.5	5 40.4	5 24.0	38	1.4	98	3.7	158	5.9
39	5 39.8	5 40.7	5 24.3	39	1.5	99	3.7	159	6.0
40	5 40.0	5 40.9	5 24.5	40	1.5	100	3.8	160	6.0
41	5 40.3	5 41.2	5 24.7	41	1.5	101	3.8	161	6.0
42	5 40.5	5 41.4	5 25.0	42	1.6	102	3.8	162	6.1
43	5 40.8	5 41.7	5 25.2	43	1.6	103	3.9	163	6.1
44	5 41.0	5 41.9	5 25.5	44	1.7	104	3.9	164	6.2
45	5 41.3	5 42.2	5 25.7	45	1.7	105	3.9	165	6.2
46	5 41.5	5 42.4	5 25.9	46	1.7	106	4.0	166	6.2
47	5 41.8	5 42.7	5 26.2	47	1.8	107	4.0	167	6.3
48	5 42.0	5 42.9	5 26.4	48	1.8	108	4.1	168	6.3
49	5 42.3	5 43.2	5 26.7	49	1.8	109	4.1	169	6.3
50	5 42.5	5 43.4	5 26.9	50	1.9	110	4.1	170	6.4
51	5 42.8	5 43.7	5 27.1	51	1.9	111	4.2	171	6.4
52	5 43.0	5 43.9	5 27.4	52	2.0	112	4.2	172	6.5
53	5 43.3	5 44.2	5 27.6	53	2.0	113	4.2	173	6.5
54	5 43.5	5 44.4	5 27.9	54	2.0	114	4.3	174	6.5
55	5 43.8	5 44.7	5 28.1	55	2.1	115	4.3	175	6.6
56	5 44.0	5 44.9	5 28.3	56	2.1	116	4.4	176	6.6
57	5 44.3	5 45.2	5 28.6	57	2.1	117	4.4	177	6.6
58	5 44.5	5 45.4	5 28.8	58	2.2	118	4.4	178	6.7
59	5 44.8	5 45.7	5 29.0	59	2.2	119	4.5	179	6.7
60	5 45.0	5 45.9	5 29.3	60	2.3	120	4.5	180	6.8

23m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	5 45.0	5 45.9	5 29.3	0	0.0	60	2.4	120	4.7
1	5 45.3	5 46.2	5 29.5	1	0.0	61	2.4	121	4.7
2	5 45.5	5 46.4	5 29.8	2	0.1	62	2.4	122	4.8
3	5 45.8	5 46.7	5 30.0	3	0.1	63	2.5	123	4.8
4	5 46.0	5 46.9	5 30.2	4	0.2	64	2.5	124	4.9
5	5 46.3	5 47.2	5 30.5	5	0.2	65	2.5	125	4.9
6	5 46.5	5 47.4	5 30.7	6	0.2	66	2.6	126	4.9
7	5 46.8	5 47.7	5 31.0	7	0.3	67	2.6	127	5.0
8	5 47.0	5 48.0	5 31.2	8	0.3	68	2.7	128	5.0
9	5 47.3	5 48.2	5 31.4	9	0.4	69	2.7	129	5.1
10	5 47.5	5 48.5	5 31.7	10	0.4	70	2.7	130	5.1
11	5 47.8	5 48.7	5 31.9	11	0.4	71	2.8	131	5.1
12	5 48.0	5 49.0	5 32.1	12	0.5	72	2.8	132	5.2
13	5 48.3	5 49.2	5 32.4	13	0.5	73	2.9	133	5.2
14	5 48.5	5 49.5	5 32.6	14	0.5	74	2.9	134	5.2
15	5 48.8	5 49.7	5 32.9	15	0.6	75	2.9	135	5.3
16	5 49.0	5 50.0	5 33.1	16	0.6	76	3.0	136	5.3
17	5 49.3	5 50.2	5 33.3	17	0.7	77	3.0	137	5.4
18	5 49.5	5 50.5	5 33.6	18	0.7	78	3.1	138	5.4
19	5 49.8	5 50.7	5 33.8	19	0.7	79	3.1	139	5.4
20	5 50.0	5 51.0	5 34.1	20	0.8	80	3.1	140	5.5
21	5 50.3	5 51.2	5 34.3	21	0.8	81	3.2	141	5.5
22	5 50.5	5 51.5	5 34.5	22	0.9	82	3.2	142	5.6
23	5 50.8	5 51.7	5 34.8	23	0.9	83	3.3	143	5.6
24	5 51.0	5 52.0	5 35.0	24	0.9	84	3.3	144	5.6
25	5 51.3	5 52.2	5 35.2	25	1.0	85	3.3	145	5.7
26	5 51.5	5 52.5	5 35.5	26	1.0	86	3.4	146	5.7
27	5 51.8	5 52.7	5 35.7	27	1.1	87	3.4	147	5.8
28	5 52.0	5 53.0	5 36.0	28	1.1	88	3.4	148	5.8
29	5 52.3	5 53.2	5 36.2	29	1.1	89	3.5	149	5.8
30	5 52.5	5 53.5	5 36.4	30	1.2	90	3.5	150	5.9
31	5 52.8	5 53.7	5 36.7	31	1.2	91	3.6	151	5.9
32	5 53.0	5 54.0	5 36.9	32	1.3	92	3.6	152	6.0
33	5 53.3	5 54.2	5 37.2	33	1.3	93	3.6	153	6.0
34	5 53.5	5 54.5	5 37.4	34	1.3	94	3.7	154	6.0
35	5 53.8	5 54.7	5 37.6	35	1.4	95	3.7	155	6.1
36	5 54.0	5 55.0	5 37.9	36	1.4	96	3.8	156	6.1
37	5 54.3	5 55.2	5 38.1	37	1.4	97	3.8	157	6.1
38	5 54.5	5 55.5	5 38.4	38	1.5	98	3.8	158	6.2
39	5 54.8	5 55.7	5 38.6	39	1.5	99	3.9	159	6.2
40	5 55.0	5 56.0	5 38.8	40	1.6	100	3.9	160	6.3
41	5 55.3	5 56.2	5 39.1	41	1.6	101	4.0	161	6.3
42	5 55.5	5 56.5	5 39.3	42	1.6	102	4.0	162	6.3
43	5 55.8	5 56.7	5 39.5	43	1.7	103	4.0	163	6.4
44	5 56.0	5 57.0	5 39.8	44	1.7	104	4.1	164	6.4
45	5 56.3	5 57.2	5 40.0	45	1.8	105	4.1	165	6.5
46	5 56.5	5 57.5	5 40.3	46	1.8	106	4.2	166	6.5
47	5 56.8	5 57.7	5 40.5	47	1.8	107	4.2	167	6.5
48	5 57.0	5 58.0	5 40.7	48	1.9	108	4.2	168	6.6
49	5 57.3	5 58.2	5 41.0	49	1.9	109	4.3	169	6.6
50	5 57.5	5 58.5	5 41.2	50	2.0	110	4.3	170	6.7
51	5 57.8	5 58.7	5 41.5	51	2.0	111	4.3	171	6.7
52	5 58.0	5 59.0	5 41.7	52	2.0	112	4.4	172	6.7
53	5 58.3	5 59.2	5 41.9	53	2.1	113	4.4	173	6.8
54	5 58.5	5 59.5	5 42.2	54	2.1	114	4.5	174	6.8
55	5 58.8	5 59.7	5 42.4	55	2.2	115	4.5	175	6.9
56	5 59.0	6 00.0	5 42.6	56	2.2	116	4.5	176	6.9
57	5 59.3	6 00.2	5 42.9	57	2.2	117	4.6	177	6.9
58	5 59.5	6 00.5	5 43.1	58	2.3	118	4.6	178	7.0
59	5 59.8	6 00.7	5 43.4	59	2.3	119	4.7	179	7.0
60	6 00.0	6 01.0	5 43.6	60	2.4	120	4.7	180	7.1

24m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	6 00.0	6 01.0	5 43.6	0	0.0	60	2.5	120	4.9
1	6 00.3	6 01.2	5 43.8	1	0.0	61	2.5	121	4.9
2	6 00.5	6 01.5	5 44.1	2	0.1	62	2.5	122	5.0
3	6 00.8	6 01.7	5 44.3	3	0.1	63	2.6	123	5.0
4	6 01.0	6 02.0	5 44.6	4	0.2	64	2.6	124	5.1
5	6 01.3	6 02.2	5 44.8	5	0.2	65	2.7	125	5.1
6	6 01.5	6 02.5	5 45.0	6	0.2	66	2.7	126	5.1
7	6 01.8	6 02.7	5 45.3	7	0.3	67	2.7	127	5.2
8	6 02.0	6 03.0	5 45.5	8	0.3	68	2.8	128	5.2
9	6 02.3	6 03.2	5 45.7	9	0.4	69	2.8	129	5.3
10	6 02.5	6 03.5	5 46.0	10	0.4	70	2.9	130	5.3
11	6 02.8	6 03.7	5 46.2	11	0.4	71	2.9	131	5.3
12	6 03.0	6 04.0	5 46.5	12	0.5	72	2.9	132	5.4
13	6 03.3	6 04.2	5 46.7	13	0.5	73	3.0	133	5.4
14	6 03.5	6 04.5	5 46.9	14	0.6	74	3.0	134	5.5
15	6 03.8	6 04.7	5 47.2	15	0.6	75	3.1	135	5.5
16	6 04.0	6 05.0	5 47.4	16	0.7	76	3.1	136	5.6
17	6 04.3	6 05.2	5 47.7	17	0.7	77	3.1	137	5.6
18	6 04.5	6 05.5	5 47.9	18	0.7	78	3.2	138	5.6
19	6 04.8	6 05.7	5 48.1	19	0.8	79	3.2	139	5.7
20	6 05.0	6 06.0	5 48.4	20	0.8	80	3.3	140	5.7
21	6 05.3	6 06.3	5 48.6	21	0.9	81	3.3	141	5.8
22	6 05.5	6 06.5	5 48.8	22	0.9	82	3.3	142	5.8
23	6 05.8	6 06.8	5 49.1	23	0.9	83	3.4	143	5.8
24	6 06.0	6 07.0	5 49.3	24	1.0	84	3.4	144	5.9
25	6 06.3	6 07.3	5 49.6	25	1.0	85	3.5	145	5.9
26	6 06.5	6 07.5	5 49.8	26	1.1	86	3.5	146	6.0
27	6 06.8	6 07.8	5 50.0	27	1.1	87	3.6	147	6.0
28	6 07.0	6 08.0	5 50.3	28	1.1	88	3.6	148	6.0
29	6 07.3	6 08.3	5 50.5	29	1.2	89	3.6	149	6.1
30	6 07.5	6 08.5	5 50.8	30	1.2	90	3.7	150	6.1
31	6 07.8	6 08.8	5 51.0	31	1.3	91	3.7	151	6.2
32	6 08.0	6 09.0	5 51.2	32	1.3	92	3.8	152	6.2
33	6 08.3	6 09.3	5 51.5	33	1.3	93	3.8	153	6.2
34	6 08.5	6 09.5	5 51.7	34	1.4	94	3.8	154	6.3
35	6 08.8	6 09.8	5 52.0	35	1.4	95	3.9	155	6.3
36	6 09.0	6 10.0	5 52.2	36	1.5	96	3.9	156	6.4
37	6 09.3	6 10.3	5 52.4	37	1.5	97	4.0	157	6.4
38	6 09.5	6 10.5	5 52.7	38	1.6	98	4.0	158	6.5
39	6 09.8	6 10.8	5 52.9	39	1.6	99	4.0	159	6.5
40	6 10.0	6 11.0	5 53.1	40	1.6	100	4.1	160	6.5
41	6 10.3	6 11.3	5 53.4	41	1.7	101	4.1	161	6.6
42	6 10.5	6 11.5	5 53.6	42	1.7	102	4.2	162	6.6
43	6 10.8	6 11.8	5 53.9	43	1.8	103	4.2	163	6.7
44	6 11.0	6 12.0	5 54.1	44	1.8	104	4.2	164	6.7
45	6 11.3	6 12.3	5 54.3	45	1.8	105	4.3	165	6.7
46	6 11.5	6 12.5	5 54.6	46	1.9	106	4.3	166	6.8
47	6 11.8	6 12.8	5 54.8	47	1.9	107	4.4	167	6.8
48	6 12.0	6 13.0	5 55.1	48	2.0	108	4.4	168	6.9
49	6 12.3	6 13.3	5 55.3	49	2.0	109	4.5	169	6.9
50	6 12.5	6 13.5	5 55.5	50	2.0	110	4.5	170	6.9
51	6 12.8	6 13.8	5 55.8	51	2.1	111	4.5	171	7.0
52	6 13.0	6 14.0	5 56.0	52	2.1	112	4.6	172	7.0
53	6 13.3	6 14.3	5 56.2	53	2.2	113	4.6	173	7.1
54	6 13.5	6 14.5	5 56.5	54	2.2	114	4.7	174	7.1
55	6 13.8	6 14.8	5 56.7	55	2.2	115	4.7	175	7.1
56	6 14.0	6 15.0	5 57.0	56	2.3	116	4.7	176	7.2
57	6 14.3	6 15.3	5 57.2	57	2.3	117	4.8	177	7.2
58	6 14.5	6 15.5	5 57.4	58	2.4	118	4.8	178	7.3
59	6 14.8	6 15.8	5 57.7	59	2.4	119	4.9	179	7.3
60	6 15.0	6 16.0	5 57.9	60	2.5	120	4.9	180	7.4

25m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	6 15.0	6 16.0	5 57.9	0	0.0	60	2.6	120	5.1
1	6 15.3	6 16.3	5 58.2	1	0.0	61	2.6	121	5.1
2	6 15.5	6 16.5	5 58.4	2	0.1	62	2.6	122	5.2
3	6 15.8	6 16.8	5 58.6	3	0.1	63	2.7	123	5.2
4	6 16.0	6 17.0	5 58.9	4	0.2	64	2.7	124	5.3
5	6 16.3	6 17.3	5 59.1	5	0.2	65	2.8	125	5.3
6	6 16.5	6 17.5	5 59.3	6	0.3	66	2.8	126	5.4
7	6 16.8	6 17.8	5 59.6	7	0.3	67	2.8	127	5.4
8	6 17.0	6 18.0	5 59.8	8	0.3	68	2.9	128	5.4
9	6 17.3	6 18.3	6 00.1	9	0.4	69	2.9	129	5.5
10	6 17.5	6 18.5	6 00.3	10	0.4	70	3.0	130	5.5
11	6 17.8	6 18.8	6 00.5	11	0.5	71	3.0	131	5.6
12	6 18.0	6 19.0	6 00.8	12	0.5	72	3.1	132	5.6
13	6 18.3	6 19.3	6 01.0	13	0.6	73	3.1	133	5.7
14	6 18.5	6 19.5	6 01.3	14	0.6	74	3.1	134	5.7
15	6 18.8	6 19.8	6 01.5	15	0.6	75	3.2	135	5.7
16	6 19.0	6 20.0	6 01.7	16	0.7	76	3.2	136	5.8
17	6 19.3	6 20.3	6 02.0	17	0.7	77	3.3	137	5.8
18	6 19.5	6 20.5	6 02.2	18	0.8	78	3.3	138	5.9
19	6 19.8	6 20.8	6 02.5	19	0.8	79	3.4	139	5.9
20	6 20.0	6 21.0	6 02.7	20	0.9	80	3.4	140	6.0
21	6 20.3	6 21.3	6 02.9	21	0.9	81	3.4	141	6.0
22	6 20.5	6 21.5	6 03.2	22	0.9	82	3.5	142	6.0
23	6 20.8	6 21.8	6 03.4	23	1.0	83	3.5	143	6.1
24	6 21.0	6 22.0	6 03.6	24	1.0	84	3.6	144	6.1
25	6 21.3	6 22.3	6 03.9	25	1.1	85	3.6	145	6.2
26	6 21.5	6 22.5	6 04.1	26	1.1	86	3.7	146	6.2
27	6 21.8	6 22.8	6 04.4	27	1.1	87	3.7	147	6.2
28	6 22.0	6 23.0	6 04.6	28	1.2	88	3.7	148	6.3
29	6 22.3	6 23.3	6 04.8	29	1.2	89	3.8	149	6.3
30	6 22.5	6 23.5	6 05.1	30	1.3	90	3.8	150	6.4
31	6 22.8	6 23.8	6 05.3	31	1.3	91	3.9	151	6.4
32	6 23.0	6 24.0	6 05.6	32	1.4	92	3.9	152	6.5
33	6 23.3	6 24.3	6 05.8	33	1.4	93	4.0	153	6.5
34	6 23.5	6 24.5	6 06.0	34	1.4	94	4.0	154	6.5
35	6 23.8	6 24.8	6 06.3	35	1.5	95	4.0	155	6.6
36	6 24.0	6 25.1	6 06.5	36	1.5	96	4.1	156	6.6
37	6 24.3	6 25.3	6 06.7	37	1.6	97	4.1	157	6.7
38	6 24.5	6 25.6	6 07.0	38	1.6	98	4.2	158	6.7
39	6 24.8	6 25.8	6 07.2	39	1.7	99	4.2	159	6.8
40	6 25.0	6 26.1	6 07.5	40	1.7	100	4.3	160	6.8
41	6 25.3	6 26.3	6 07.7	41	1.7	101	4.3	161	6.8
42	6 25.5	6 26.6	6 07.9	42	1.8	102	4.3	162	6.9
43	6 25.8	6 26.8	6 08.2	43	1.8	103	4.4	163	6.9
44	6 26.0	6 27.1	6 08.4	44	1.9	104	4.4	164	7.0
45	6 26.3	6 27.3	6 08.7	45	1.9	105	4.5	165	7.0
46	6 26.5	6 27.6	6 08.9	46	2.0	106	4.5	166	7.1
47	6 26.8	6 27.8	6 09.1	47	2.0	107	4.5	167	7.1
48	6 27.0	6 28.1	6 09.4	48	2.0	108	4.6	168	7.1
49	6 27.3	6 28.3	6 09.6	49	2.1	109	4.6	169	7.2
50	6 27.5	6 28.6	6 09.8	50	2.1	110	4.7	170	7.2
51	6 27.8	6 28.8	6 10.1	51	2.2	111	4.7	171	7.3
52	6 28.0	6 29.1	6 10.3	52	2.2	112	4.8	172	7.3
53	6 28.3	6 29.3	6 10.6	53	2.3	113	4.8	173	7.4
54	6 28.5	6 29.6	6 10.8	54	2.3	114	4.8	174	7.4
55	6 28.8	6 29.8	6 11.0	55	2.3	115	4.9	175	7.4
56	6 29.0	6 30.1	6 11.3	56	2.4	116	4.9	176	7.5
57	6 29.3	6 30.3	6 11.5	57	2.4	117	5.0	177	7.5
58	6 29.5	6 30.6	6 11.8	58	2.5	118	5.0	178	7.6
59	6 29.8	6 30.8	6 12.0	59	2.5	119	5.1	179	7.6
60	6 30.0	6 31.1	6 12.2	60	2.6	120	5.1	180	7.7

26m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	6 30.0	6 31.1	6 12.2	0	0.0	60	2.7	120	5.3
1	6 30.3	6 31.3	6 12.5	1	0.0	61	2.7	121	5.3
2	6 30.5	6 31.6	6 12.7	2	0.1	62	2.7	122	5.4
3	6 30.8	6 31.8	6 12.9	3	0.1	63	2.8	123	5.4
4	6 31.0	6 32.1	6 13.2	4	0.2	64	2.8	124	5.5
5	6 31.3	6 32.3	6 13.4	5	0.2	65	2.9	125	5.5
6	6 31.5	6 32.6	6 13.7	6	0.3	66	2.9	126	5.6
7	6 31.8	6 32.8	6 13.9	7	0.3	67	3.0	127	5.6
8	6 32.0	6 33.1	6 14.1	8	0.4	68	3.0	128	5.7
9	6 32.3	6 33.3	6 14.4	9	0.4	69	3.0	129	5.7
10	6 32.5	6 33.6	6 14.6	10	0.4	70	3.1	130	5.7
11	6 32.8	6 33.8	6 14.9	11	0.5	71	3.1	131	5.8
12	6 33.0	6 34.1	6 15.1	12	0.5	72	3.2	132	5.8
13	6 33.3	6 34.3	6 15.3	13	0.6	73	3.2	133	5.9
14	6 33.5	6 34.6	6 15.6	14	0.6	74	3.3	134	5.9
15	6 33.8	6 34.8	6 15.8	15	0.7	75	3.3	135	6.0
16	6 34.0	6 35.1	6 16.1	16	0.7	76	3.4	136	6.0
17	6 34.3	6 35.3	6 16.3	17	0.8	77	3.4	137	6.1
18	6 34.5	6 35.6	6 16.5	18	0.8	78	3.4	138	6.1
19	6 34.8	6 35.8	6 16.8	19	0.8	79	3.5	139	6.1
20	6 35.0	6 36.1	6 17.0	20	0.9	80	3.5	140	6.2
21	6 35.3	6 36.3	6 17.2	21	0.9	81	3.6	141	6.2
22	6 35.5	6 36.6	6 17.5	22	1.0	82	3.6	142	6.3
23	6 35.8	6 36.8	6 17.7	23	1.0	83	3.7	143	6.3
24	6 36.0	6 37.1	6 18.0	24	1.1	84	3.7	144	6.4
25	6 36.3	6 37.3	6 18.2	25	1.1	85	3.8	145	6.4
26	6 36.5	6 37.6	6 18.4	26	1.1	86	3.8	146	6.4
27	6 36.8	6 37.8	6 18.7	27	1.2	87	3.8	147	6.5
28	6 37.0	6 38.1	6 18.9	28	1.2	88	3.9	148	6.5
29	6 37.3	6 38.3	6 19.2	29	1.3	89	3.9	149	6.6
30	6 37.5	6 38.6	6 19.4	30	1.3	90	4.0	150	6.6
31	6 37.8	6 38.8	6 19.6	31	1.4	91	4.0	151	6.7
32	6 38.0	6 39.1	6 19.9	32	1.4	92	4.1	152	6.7
33	6 38.3	6 39.3	6 20.1	33	1.5	93	4.1	153	6.8
34	6 38.5	6 39.6	6 20.3	34	1.5	94	4.2	154	6.8
35	6 38.8	6 39.8	6 20.6	35	1.5	95	4.2	155	6.8
36	6 39.0	6 40.1	6 20.8	36	1.6	96	4.2	156	6.9
37	6 39.3	6 40.3	6 21.1	37	1.6	97	4.3	157	6.9
38	6 39.5	6 40.6	6 21.3	38	1.7	98	4.3	158	7.0
39	6 39.8	6 40.8	6 21.5	39	1.7	99	4.4	159	7.0
40	6 40.0	6 41.1	6 21.8	40	1.8	100	4.4	160	7.1
41	6 40.3	6 41.3	6 22.0	41	1.8	101	4.5	161	7.1
42	6 40.5	6 41.6	6 22.3	42	1.9	102	4.5	162	7.2
43	6 40.8	6 41.8	6 22.5	43	1.9	103	4.5	163	7.2
44	6 41.0	6 42.1	6 22.7	44	1.9	104	4.6	164	7.2
45	6 41.3	6 42.3	6 23.0	45	2.0	105	4.6	165	7.3
46	6 41.5	6 42.6	6 23.2	46	2.0	106	4.7	166	7.3
47	6 41.8	6 42.8	6 23.4	47	2.1	107	4.7	167	7.4
48	6 42.0	6 43.1	6 23.7	48	2.1	108	4.8	168	7.4
49	6 42.3	6 43.4	6 23.9	49	2.2	109	4.8	169	7.5
50	6 42.5	6 43.6	6 24.2	50	2.2	110	4.9	170	7.5
51	6 42.8	6 43.9	6 24.4	51	2.3	111	4.9	171	7.6
52	6 43.0	6 44.1	6 24.6	52	2.3	112	4.9	172	7.6
53	6 43.3	6 44.4	6 24.9	53	2.3	113	5.0	173	7.6
54	6 43.5	6 44.6	6 25.1	54	2.4	114	5.0	174	7.7
55	6 43.8	6 44.9	6 25.4	55	2.4	115	5.1	175	7.7
56	6 44.0	6 45.1	6 25.6	56	2.5	116	5.1	176	7.8
57	6 44.3	6 45.4	6 25.8	57	2.5	117	5.2	177	7.8
58	6 44.5	6 45.6	6 26.1	58	2.6	118	5.2	178	7.9
59	6 44.8	6 45.9	6 26.3	59	2.6	119	5.3	179	7.9
60	6 45.0	6 46.1	6 26.6	60	2.7	120	5.3	180	8.0

27m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	6 45.0	6 46.1	6 26.6	0	0.0	60	2.8	120	5.5
1	6 45.3	6 46.4	6 26.8	1	0.0	61	2.8	121	5.5
2	6 45.5	6 46.6	6 27.0	2	0.1	62	2.8	122	5.6
3	6 45.8	6 46.9	6 27.3	3	0.1	63	2.9	123	5.6
4	6 46.0	6 47.1	6 27.5	4	0.2	64	2.9	124	5.7
5	6 46.3	6 47.4	6 27.7	5	0.2	65	3.0	125	5.7
6	6 46.5	6 47.6	6 28.0	6	0.3	66	3.0	126	5.8
7	6 46.8	6 47.9	6 28.2	7	0.3	67	3.1	127	5.8
8	6 47.0	6 48.1	6 28.5	8	0.4	68	3.1	128	5.9
9	6 47.3	6 48.4	6 28.7	9	0.4	69	3.2	129	5.9
10	6 47.5	6 48.6	6 28.9	10	0.5	70	3.2	130	6.0
11	6 47.8	6 48.9	6 29.2	11	0.5	71	3.3	131	6.0
12	6 48.0	6 49.1	6 29.4	12	0.6	72	3.3	132	6.1
13	6 48.3	6 49.4	6 29.7	13	0.6	73	3.3	133	6.1
14	6 48.5	6 49.6	6 29.9	14	0.6	74	3.4	134	6.1
15	6 48.8	6 49.9	6 30.1	15	0.7	75	3.4	135	6.2
16	6 49.0	6 50.1	6 30.4	16	0.7	76	3.5	136	6.2
17	6 49.3	6 50.4	6 30.6	17	0.8	77	3.5	137	6.3
18	6 49.5	6 50.6	6 30.8	18	0.8	78	3.6	138	6.3
19	6 49.8	6 50.9	6 31.1	19	0.9	79	3.6	139	6.4
20	6 50.0	6 51.1	6 31.3	20	0.9	80	3.7	140	6.4
21	6 50.3	6 51.4	6 31.6	21	1.0	81	3.7	141	6.5
22	6 50.5	6 51.6	6 31.8	22	1.0	82	3.8	142	6.5
23	6 50.8	6 51.9	6 32.0	23	1.1	83	3.8	143	6.6
24	6 51.0	6 52.1	6 32.3	24	1.1	84	3.9	144	6.6
25	6 51.3	6 52.4	6 32.5	25	1.1	85	3.9	145	6.6
26	6 51.5	6 52.6	6 32.8	26	1.2	86	3.9	146	6.7
27	6 51.8	6 52.9	6 33.0	27	1.2	87	4.0	147	6.7
28	6 52.0	6 53.1	6 33.2	28	1.3	88	4.0	148	6.8
29	6 52.3	6 53.4	6 33.5	29	1.3	89	4.1	149	6.8
30	6 52.5	6 53.6	6 33.7	30	1.4	90	4.1	150	6.9
31	6 52.8	6 53.9	6 33.9	31	1.4	91	4.2	151	6.9
32	6 53.0	6 54.1	6 34.2	32	1.5	92	4.2	152	7.0
33	6 53.3	6 54.4	6 34.4	33	1.5	93	4.3	153	7.0
34	6 53.5	6 54.6	6 34.7	34	1.6	94	4.3	154	7.1
35	6 53.8	6 54.9	6 34.9	35	1.6	95	4.4	155	7.1
36	6 54.0	6 55.1	6 35.1	36	1.7	96	4.4	156	7.2
37	6 54.3	6 55.4	6 35.4	37	1.7	97	4.4	157	7.2
38	6 54.5	6 55.6	6 35.6	38	1.7	98	4.5	158	7.2
39	6 54.8	6 55.9	6 35.9	39	1.8	99	4.5	159	7.3
40	6 55.0	6 56.1	6 36.1	40	1.8	100	4.6	160	7.3
41	6 55.3	6 56.4	6 36.3	41	1.9	101	4.6	161	7.4
42	6 55.5	6 56.6	6 36.6	42	1.9	102	4.7	162	7.4
43	6 55.8	6 56.9	6 36.8	43	2.0	103	4.7	163	7.5
44	6 56.0	6 57.1	6 37.0	44	2.0	104	4.8	164	7.5
45	6 56.3	6 57.4	6 37.3	45	2.1	105	4.8	165	7.6
46	6 56.5	6 57.6	6 37.5	46	2.1	106	4.9	166	7.6
47	6 56.8	6 57.9	6 37.8	47	2.2	107	4.9	167	7.7
48	6 57.0	6 58.1	6 38.0	48	2.2	108	5.0	168	7.7
49	6 57.3	6 58.4	6 38.2	49	2.2	109	5.0	169	7.7
50	6 57.5	6 58.6	6 38.5	50	2.3	110	5.0	170	7.8
51	6 57.8	6 58.9	6 38.7	51	2.3	111	5.1	171	7.8
52	6 58.0	6 59.1	6 39.0	52	2.4	112	5.1	172	7.9
53	6 58.3	6 59.4	6 39.2	53	2.4	113	5.2	173	7.9
54	6 58.5	6 59.6	6 39.4	54	2.5	114	5.2	174	8.0
55	6 58.8	6 59.9	6 39.7	55	2.5	115	5.3	175	8.0
56	6 59.0	7 00.1	6 39.9	56	2.6	116	5.3	176	8.1
57	6 59.3	7 00.4	6 40.2	57	2.6	117	5.4	177	8.1
58	6 59.5	7 00.6	6 40.4	58	2.7	118	5.4	178	8.2
59	6 59.8	7 00.9	6 40.6	59	2.7	119	5.5	179	8.2
60	7 00.0	7 01.1	6 40.9	60	2.8	120	5.5	180	8.3

28m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	7 00.0	7 01.1	6 40.9	0	0.0	60	2.9	120	5.7
1	7 00.3	7 01.4	6 41.1	1	0.0	61	2.9	121	5.7
2	7 00.5	7 01.7	6 41.3	2	0.1	62	2.9	122	5.8
3	7 00.8	7 01.9	6 41.6	3	0.1	63	3.0	123	5.8
4	7 01.0	7 02.2	6 41.8	4	0.2	64	3.0	124	5.9
5	7 01.3	7 02.4	6 42.1	5	0.2	65	3.1	125	5.9
6	7 01.5	7 02.7	6 42.3	6	0.3	66	3.1	126	6.0
7	7 01.8	7 02.9	6 42.5	7	0.3	67	3.2	127	6.0
8	7 02.0	7 03.2	6 42.8	8	0.4	68	3.2	128	6.1
9	7 02.3	7 03.4	6 43.0	9	0.4	69	3.3	129	6.1
10	7 02.5	7 03.7	6 43.3	10	0.5	70	3.3	130	6.2
11	7 02.8	7 03.9	6 43.5	11	0.5	71	3.4	131	6.2
12	7 03.0	7 04.2	6 43.7	12	0.6	72	3.4	132	6.3
13	7 03.3	7 04.4	6 44.0	13	0.6	73	3.5	133	6.3
14	7 03.5	7 04.7	6 44.2	14	0.7	74	3.5	134	6.4
15	7 03.8	7 04.9	6 44.4	15	0.7	75	3.6	135	6.4
16	7 04.0	7 05.2	6 44.7	16	0.8	76	3.6	136	6.5
17	7 04.3	7 05.4	6 44.9	17	0.8	77	3.7	137	6.5
18	7 04.5	7 05.7	6 45.2	18	0.9	78	3.7	138	6.6
19	7 04.8	7 05.9	6 45.4	19	0.9	79	3.8	139	6.6
20	7 05.0	7 06.2	6 45.6	20	1.0	80	3.8	140	6.7
21	7 05.3	7 06.4	6 45.9	21	1.0	81	3.8	141	6.7
22	7 05.5	7 06.7	6 46.1	22	1.0	82	3.9	142	6.7
23	7 05.8	7 06.9	6 46.4	23	1.1	83	3.9	143	6.8
24	7 06.0	7 07.2	6 46.6	24	1.1	84	4.0	144	6.8
25	7 06.3	7 07.4	6 46.8	25	1.2	85	4.0	145	6.9
26	7 06.5	7 07.7	6 47.1	26	1.2	86	4.1	146	6.9
27	7 06.8	7 07.9	6 47.3	27	1.3	87	4.1	147	7.0
28	7 07.0	7 08.2	6 47.5	28	1.3	88	4.2	148	7.0
29	7 07.3	7 08.4	6 47.8	29	1.4	89	4.2	149	7.1
30	7 07.5	7 08.7	6 48.0	30	1.4	90	4.3	150	7.1
31	7 07.8	7 08.9	6 48.3	31	1.5	91	4.3	151	7.2
32	7 08.0	7 09.2	6 48.5	32	1.5	92	4.4	152	7.2
33	7 08.3	7 09.4	6 48.7	33	1.6	93	4.4	153	7.3
34	7 08.5	7 09.7	6 49.0	34	1.6	94	4.5	154	7.3
35	7 08.8	7 09.9	6 49.2	35	1.7	95	4.5	155	7.4
36	7 09.0	7 10.2	6 49.5	36	1.7	96	4.6	156	7.4
37	7 09.3	7 10.4	6 49.7	37	1.8	97	4.6	157	7.5
38	7 09.5	7 10.7	6 49.9	38	1.8	98	4.7	158	7.5
39	7 09.8	7 10.9	6 50.2	39	1.9	99	4.7	159	7.6
40	7 10.0	7 11.2	6 50.4	40	1.9	100	4.8	160	7.6
41	7 10.3	7 11.4	6 50.6	41	1.9	101	4.8	161	7.6
42	7 10.5	7 11.7	6 50.9	42	2.0	102	4.8	162	7.7
43	7 10.8	7 11.9	6 51.1	43	2.0	103	4.9	163	7.7
44	7 11.0	7 12.2	6 51.4	44	2.1	104	4.9	164	7.8
45	7 11.3	7 12.4	6 51.6	45	2.1	105	5.0	165	7.8
46	7 11.5	7 12.7	6 51.8	46	2.2	106	5.0	166	7.9
47	7 11.8	7 12.9	6 52.1	47	2.2	107	5.1	167	7.9
48	7 12.0	7 13.2	6 52.3	48	2.3	108	5.1	168	8.0
49	7 12.3	7 13.4	6 52.6	49	2.3	109	5.2	169	8.0
50	7 12.5	7 13.7	6 52.8	50	2.4	110	5.2	170	8.1
51	7 12.8	7 13.9	6 53.0	51	2.4	111	5.3	171	8.1
52	7 13.0	7 14.2	6 53.3	52	2.5	112	5.3	172	8.2
53	7 13.3	7 14.4	6 53.5	53	2.5	113	5.4	173	8.2
54	7 13.5	7 14.7	6 53.8	54	2.6	114	5.4	174	8.3
55	7 13.8	7 14.9	6 54.0	55	2.6	115	5.5	175	8.3
56	7 14.0	7 15.2	6 54.2	56	2.7	116	5.5	176	8.4
57	7 14.3	7 15.4	6 54.5	57	2.7	117	5.6	177	8.4
58	7 14.5	7 15.7	6 54.7	58	2.8	118	5.6	178	8.5
59	7 14.8	7 15.9	6 54.9	59	2.8	119	5.7	179	8.5
60	7 15.0	7 16.2	6 55.2	60	2.9	120	5.7	180	8.6

29m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	7 15.0	7 16.2	6 55.2	0	0.0	60	3.0	120	5.9
1	7 15.3	7 16.4	6 55.4	1	0.0	61	3.0	121	5.9
2	7 15.5	7 16.7	6 55.7	2	0.1	62	3.0	122	6.0
3	7 15.8	7 16.9	6 55.9	3	0.1	63	3.1	123	6.0
4	7 16.0	7 17.2	6 56.1	4	0.2	64	3.1	124	6.1
5	7 16.3	7 17.4	6 56.4	5	0.2	65	3.2	125	6.1
6	7 16.5	7 17.7	6 56.6	6	0.3	66	3.2	126	6.2
7	7 16.8	7 17.9	6 56.9	7	0.3	67	3.3	127	6.2
8	7 17.0	7 18.2	6 57.1	8	0.4	68	3.3	128	6.3
9	7 17.3	7 18.4	6 57.3	9	0.4	69	3.4	129	6.3
10	7 17.5	7 18.7	6 57.6	10	0.5	70	3.4	130	6.4
11	7 17.8	7 18.9	6 57.8	11	0.5	71	3.5	131	6.4
12	7 18.0	7 19.2	6 58.0	12	0.6	72	3.5	132	6.5
13	7 18.3	7 19.4	6 58.3	13	0.6	73	3.6	133	6.5
14	7 18.5	7 19.7	6 58.5	14	0.7	74	3.6	134	6.6
15	7 18.8	7 20.0	6 58.8	15	0.7	75	3.7	135	6.6
16	7 19.0	7 20.2	6 59.0	16	0.8	76	3.7	136	6.7
17	7 19.3	7 20.5	6 59.2	17	0.8	77	3.8	137	6.7
18	7 19.5	7 20.7	6 59.5	18	0.9	78	3.8	138	6.8
19	7 19.8	7 21.0	6 59.7	19	0.9	79	3.9	139	6.8
20	7 20.0	7 21.2	7 00.0	20	1.0	80	3.9	140	6.9
21	7 20.3	7 21.5	7 00.2	21	1.0	81	4.0	141	6.9
22	7 20.5	7 21.7	7 00.4	22	1.1	82	4.0	142	7.0
23	7 20.8	7 22.0	7 00.7	23	1.1	83	4.1	143	7.0
24	7 21.0	7 22.2	7 00.9	24	1.2	84	4.1	144	7.1
25	7 21.3	7 22.5	7 01.1	25	1.2	85	4.2	145	7.1
26	7 21.5	7 22.7	7 01.4	26	1.3	86	4.2	146	7.2
27	7 21.8	7 23.0	7 01.6	27	1.3	87	4.3	147	7.2
28	7 22.0	7 23.2	7 01.9	28	1.4	88	4.3	148	7.3
29	7 22.3	7 23.5	7 02.1	29	1.4	89	4.4	149	7.3
30	7 22.5	7 23.7	7 02.3	30	1.5	90	4.4	150	7.4
31	7 22.8	7 24.0	7. 02.6	31	1.5	91	4.5	151	7.4
32	7 23.0	7 24.2	7 02.8	32	1.6	92	4.5	152	7.5
33	7 23.3	7 24.5	7 03.1	33	1.6	93	4.6	153	7.5
34	7 23.5	7 24.7	7 03.3	34	1.7	94	4.6	154	7.6
35	7 23.8	7 25.0	7 03.5	35	1.7	95	4.7	155	7.6
36	7 24.0	7 25.2	7 03.8	36	1.8	96	4.7	156	7.7
37	7 24.3	7 25.5	7 04.0	37	1.8	97	4.8	157	7.7
38	7 24.5	7 25.7	7 04.3	38	1.9	98	4.8	158	7.8
39	7 24.8	7 26.0	7 04.5	39	1.9	99	4.9	159	7.8
40	7 25.0	7 26.2	7 04.7	40	2.0	100	4.9	160	7.9
41	7 25.3	7 26.5	7 05.0	41	2.0	101	5.0	161	7.9
42	7 25.5	7 26.7	7 05.2	42	2.1	102	5.0	162	8.0
43	7 25.8	7 27.0	7 05.4	43	2.1	103	5.1	163	8.0
44	7 26.0	7 27.2	7 05.7	44	2.2	104	5.1	164	8.1
45	7 26.3	7 27.5	7 05.9	45	2.2	105	5.2	165	8.1
46	7 26.5	7 27.7	7 06.2	46	2.3	106	5.2	166	8.2
47	7 26.8	7 28.0	7 06.4	47	2.3	107	5.3	167	8.2
48	7 27.0	7 28.2	7 06.6	48	2.4	108	5.3	168	8.3
49	7 27.3	7 28.5	7 06.9	49	2.4	109	5.4	169	8.3
50	7 27.5	7 28.7	7 07.1	50	2.5	110	5.4	170	8.4
51	7 27.8	7 29.0	7 07.4	51	2.5	111	5.5	171	8.4
52	7 28.0	7 29.2	7 07.6	52	2.6	112	5.5	172	8.5
53	7 28.3	7 29.5	7 07.8	53	2.6	113	5.6	173	8.5
54	7 28.5	7 29.7	7 08.1	54	2.7	114	5.6	174	8.6
55	7 28.8	7 30.0	7 08.3	55	2.7	115	5.7	175	8.6
56	7 29.0	7 30.2	7 08.5	56	2.8	116	5.7	176	8.7
57	7 29.3	7 30.5	7 08.8	57	2.8	117	5.8	177	8.7
58	7 29.5	7 30.7	7 09.0	58	2.9	118	5.8	178	8.8
59	7 29.8	7 31.0	7 09.3	59	2.9	119	5.9	179	8.8
60	7 30.0	7 31.2	7 09.5	60	3.0	120	5.9	180	8.9

30m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	7 30.0	7 31.2	7 09.5	0	0.0	60	3.1	120	6.1
1	7 30.3	7 31.5	7 09.7	1	0.1	61	3.1	121	6.2
2	7 30.5	7 31.7	7 10.0	2	0.1	62	3.2	122	6.2
3	7 30.8	7 32.0	7 10.2	3	0.2	63	3.2	123	6.3
4	7 31.0	7 32.2	7 10.5	4	0.2	64	3.3	124	6.3
5	7 31.3	7 32.5	7 10.7	5	0.3	65	3.3	125	6.4
6	7 31.5	7 32.7	7 10.9	6	0.3	66	3.4	126	6.4
7	7 31.8	7 33.0	7 11.2	7	0.4	67	3.4	127	6.5
8	7 32.0	7 33.2	7 11.4	8	0.4	68	3.5	128	6.5
9	7 32.3	7 33.5	7 11.6	9	0.5	69	3.5	129	6.6
10	7 32.5	7 33.7	7 11.9	10	0.5	70	3.6	130	6.6
11	7 32.8	7 34.0	7 12.1	11	0.6	71	3.6	131	6.7
12	7 33.0	7 34.2	7 12.4	12	0.6	72	3.7	132	6.7
13	7 33.3	7 34.5	7 12.6	13	0.7	73	3.7	133	6.8
14	7 33.5	7 34.7	7 12.8	14	0.7	74	3.8	134	6.8
15	7 33.8	7 35.0	7 13.1	15	0.8	75	3.8	135	6.9
16	7 34.0	7 35.2	7 13.3	16	0.8	76	3.9	136	6.9
17	7 34.3	7 35.5	7 13.6	17	0.9	77	3.9	137	7.0
18	7 34.5	7 35.7	7 13.8	18	0.9	78	4.0	138	7.0
19	7 34.8	7 36.0	7 14.0	19	1.0	79	4.0	139	7.1
20	7 35.0	7 36.2	7 14.3	20	1.0	80	4.1	140	7.1
21	7 35.3	7 36.5	7 14.5	21	1.1	81	4.1	141	7.2
22	7 35.5	7 36.7	7 14.7	22	1.1	82	4.2	142	7.2
23	7 35.8	7 37.0	7 15.0	23	1.2	83	4.2	143	7.3
24	7 36.0	7 37.2	7 15.2	24	1.2	84	4.3	144	7.3
25	7 36.3	7 37.5	7 15.5	25	1.3	85	4.3	145	7.4
26	7 36.5	7 37.7	7 15.7	26	1.3	86	4.4	146	7.4
27	7 36.8	7 38.0	7 15.9	27	1.4	87	4.4	147	7.5
28	7 37.0	7 38.3	7 16.2	28	1.4	88	4.5	148	7.5
29	7 37.3	7 38.5	7 16.4	29	1.5	89	4.5	149	7.6
30	7 37.5	7 38.8	7 16.7	30	1.5	90	4.6	150	7.6
31	7 37.8	7 39.0	7 16.9	31	1.6	91	4.6	151	7.7
32	7 38.0	7 39.3	7 17.1	32	1.6	92	4.7	152	7.7
33	7 38.3	7 39.5	7 17.4	33	1.7	93	4.7	153	7.8
34	7 38.5	7 39.8	7 17.6	34	1.7	94	4.8	154	7.8
35	7 38.8	7 40.0	7 17.9	35	1.8	95	4.8	155	7.9
36	7 39.0	7 40.3	7 18.1	36	1.8	96	4.9	156	7.9
37	7 39.3	7 40.5	7 18.3	37	1.9	97	4.9	157	8.0
38	7 39.5	7 40.8	7 18.6	38	1.9	98	5.0	158	8.0
39	7 39.8	7 41.0	7 18.8	39	2.0	99	5.0	159	8.1
40	7 40.0	7 41.3	7 19.0	40	2.0	100	5.1	160	8.1
41	7 40.3	7 41.5	7 19.3	41	2.1	101	5.1	161	8.2
42	7 40.5	7 41.8	7 19.5	42	2.1	102	5.2	162	8.2
43	7 40.8	7 42.0	7 19.8	43	2.2	103	5.2	163	8.3
44	7 41.0	7 42.3	7 20.0	44	2.2	104	5.3	164	8.3
45	7 41.3	7 42.5	7 20.2	45	2.3	105	5.3	165	8.4
46	7 41.5	7 42.8	7 20.5	46	2.3	106	5.4	166	8.4
47	7 41.8	7 43.0	7 20.7	47	2.4	107	5.4	167	8.5
48	7 42.0	7 43.3	7 21.0	48	2.4	108	5.5	168	8.5
49	7 42.3	7 43.5	7 21.2	49	2.5	109	5.5	169	8.6
50	7 42.5	7 43.8	7 21.4	50	2.5	110	5.6	170	8.6
51	7 42.8	7 44.0	7 21.7	51	2.6	111	5.6	171	8.7
52	7 43.0	7 44.3	7 21.9	52	2.6	112	5.7	172	8.7
53	7 43.3	7 44.5	7 22.1	53	2.7	113	5.7	173	8.8
54	7 43.5	7 44.8	7 22.4	54	2.7	114	5.8	174	8.8
55	7 43.8	7 45.0	7 22.6	55	2.8	115	5.8	175	8.9
56	7 44.0	7 45.3	7 22.9	56	2.8	116	5.9	176	8.9
57	7 44.3	7 45.5	7 23.1	57	2.9	117	5.9	177	9.0
58	7 44.5	7 45.8	7 23.3	58	2.9	118	6.0	178	9.0
59	7 44.8	7 46.0	7 23.6	59	3.0	119	6.0	179	9.1
60	7 45.0	7 46.3	7 23.8	60	3.1	120	6.1	180	9.2

31m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	7 45.0	7 46.3	7 23.8	0	0.0	60	3.2	120	6.3
1	7 45.3	7 46.5	7 24.1	1	0.1	61	3.2	121	6.4
2	7 45.5	7 46.8	7 24.3	2	0.1	62	3.3	122	6.4
3	7 45.8	7 47.0	7 24.5	3	0.2	63	3.3	123	6.5
4	7 46.0	7 47.3	7 24.8	4	0.2	64	3.4	124	6.5
5	7 46.3	7 47.5	7 25.0	5	0.3	65	3.4	125	6.6
6	7 46.5	7 47.8	7 25.2	6	0.3	66	3.5	126	6.6
7	7 46.8	7 48.0	7 25.5	7	0.4	67	3.5	127	6.7
8	7 47.0	7 48.3	7 25.7	8	0.4	68	3.6	128	6.7
9	7 47.3	7 48.5	7 26.0	9	0.5	69	3.6	129	6.8
10	7 47.5	7 48.8	7 26.2	10	0.5	70	3.7	130	6.8
11	7 47.8	7 49.0	7 26.4	11	0.6	71	3.7	131	6.9
12	7 48.0	7 49.3	7 26.7	12	0.6	72	3.8	132	6.9
13	7 48.3	7 49.5	7 26.9	13	0.7	73	3.8	133	7.0
14	7 48.5	7 49.8	7 27.2	14	0.7	74	3.9	134	7.0
15	7 48.8	7 50.0	7 27.4	15	0.8	75	3.9	135	7.1
16	7 49.0	7 50.3	7 27.6	16	0.8	76	4.0	136	7.1
17	7 49.3	7 50.5	7 27.9	17	0.9	77	4.0	137	7.2
18	7 49.5	7 50.8	7 28.1	18	0.9	78	4.1	138	7.2
19	7 49.8	7 51.0	7 28.4	19	1.0	79	4.1	139	7.3
20	7 50.0	7 51.3	7 28.6	20	1.1	80	4.2	140	7.4
21	7 50.3	7 51.5	7 28.8	21	1.1	81	4.3	141	7.4
22	7 50.5	7 51.8	7 29.1	22	1.2	82	4.3	142	7.5
23	7 50.8	7 52.0	7 29.3	23	1.2	83	4.4	143	7.5
24	7 51.0	7 52.3	7 29.5	24	1.3	84	4.4	144	7.6
25	7 51.3	7 52.5	7 29.8	25	1.3	85	4.5	145	7.6
26	7 51.5	7 52.8	7 30.0	26	1.4	86	4.5	146	7.7
27	7 51.8	7 53.0	7 30.3	27	1.4	87	4.6	147	7.7
28	7 52.0	7 53.3	7 30.5	28	1.5	88	4.6	148	7.8
29	7 52.3	7 53.5	7 30.7	29	1.5	89	4.7	149	7.8
30	7 52.5	7 53.8	7 31.0	30	1.6	90	4.7	150	7.9
31	7 52.8	7 54.0	7 31.2	31	1.6	91	4.8	151	7.9
32	7 53.0	7 54.3	7 31.5	32	1.7	92	4.8	152	8.0
33	7 53.3	7 54.5	7 31.7	33	1.7	93	4.9	153	8.0
34	7 53.5	7 54.8	7 31.9	34	1.8	94	4.9	154	8.1
35	7 53.8	7 55.0	7 32.2	35	1.8	95	5.0	155	8.1
36	7 54.0	7 55.3	7 32.4	36	1.9	96	5.0	156	8.2
37	7 54.3	7 55.5	7 32.6	37	1.9	97	5.1	157	8.2
38	7 54.5	7 55.8	7 32.9	38	2.0	98	5.1	158	8.3
39	7 54.8	7 56.0	7 33.1	39	2.0	99	5.2	159	8.3
40	7 55.0	7 56.3	7 33.4	40	2.1	100	5.3	160	8.4
41	7 55.3	7 56.6	7 33.6	41	2.2	101	5.3	161	8.5
42	7 55.5	7 56.8	7 33.8	42	2.2	102	5.4	162	8.5
43	7 55.8	7 57.1	7 34.1	43	2.3	103	5.4	163	8.6
44	7 56.0	7 57.3	7 34.3	44	2.3	104	5.5	164	8.6
45	7 56.3	7 57.6	7 34.6	45	2.4	105	5.5	165	8.7
46	7 56.5	7 57.8	7 34.8	46	2.4	106	5.6	166	8.7
47	7 56.8	7 58.1	7 35.0	47	2.5	107	5.6	167	8.8
48	7 57.0	7 58.3	7 35.3	48	2.5	108	5.7	168	8.8
49	7 57.3	7 58.6	7 35.5	49	2.6	109	5.7	169	8.9
50	7 57.5	7 58.8	7 35.7	50	2.6	110	5.8	170	8.9
51	7 57.8	7 59.1	7 36.0	51	2.7	111	5.8	171	9.0
52	7 58.0	7 59.3	7 36.2	52	2.7	112	5.9	172	9.0
53	7 58.3	7 59.6	7 36.5	53	2.8	113	5.9	173	9.1
54	7 58.5	7 59.8	7 36.7	54	2.8	114	6.0	174	9.1
55	7 58.8	8 00.1	7 36.9	55	2.9	115	6.0	175	9.2
56	7 59.0	8 00.3	7 37.2	56	2.9	116	6.1	176	9.2
57	7 59.3	8 00.6	7 37.4	57	3.0	117	6.1	177	9.3
58	7 59.5	8 00.8	7 37.7	58	3.0	118	6.2	178	9.3
59	7 59.8	8 01.1	7 37.9	59	3.1	119	6.2	179	9.4
60	8 00.0	8 01.3	7 38.1	60	3.2	120	6.3	180	9.5

918768°—52——19

32m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	8 00.0	8 01.3	7 38.1	0	0.0	60	3.3	120	6.5
1	8 00.3	8 01.6	7 38.4	1	0.1	61	3.3	121	6.6
2	8 00.5	8 01.8	7 38.6	2	0.1	62	3.4	122	6.6
3	8 00.8	8 02.1	7 38.8	3	0.2	63	3.4	123	6.7
4	8 01.0	8 02.3	7 39.1	4	0.2	64	3.5	124	6.7
5	8 01.3	8 02.6	7 39.3	5	0.3	65	3.5	125	6.8
6	8 01.5	8 02.8	7 39.6	6	0.3	66	3.6	126	6.8
7	8 01.8	8 03.1	7 39.8	7	0.4	67	3.6	127	6.9
8	8 02.0	8 03.3	7 40.0	8	0.4	68	3.7	128	6.9
9	8 02.3	8 03.6	7 40.3	9	0.5	69	3.7	129	7.0
10	8 02.5	8 03.8	7 40.5	10	0.5	70	3.8	130	7.0
11	8 02.8	8 04.1	7 40.8	11	0.6	71	3.8	131	7.1
12	8 03.0	8 04.3	7 41.0	12	0.7	72	3.9	132	7.2
13	8 03.3	8 04.6	7 41.2	13	0.7	73	4.0	133	7.2
14	8 03.5	8 04.8	7 41.5	14	0.8	74	4.0	134	7.3
15	8 03.8	8 05.1	7 41.7	15	0.8	75	4.1	135	7.3
16	8 04.0	8 05.3	7 42.0	16	0.9	76	4.1	136	7.4
17	8 04.3	8 05.6	7 42.2	17	0.9	77	4.2	137	7.4
18	8 04.5	8 05.8	7 42.4	18	1.0	78	4.2	138	7.5
19	8 04.8	8 06.1	7 42.7	19	1.0	79	4.3	139	7.5
20	8 05.0	8 06.3	7 42.9	20	1.1	80	4.3	140	7.6
21	8 05.3	8 06.6	7 43.1	21	1.1	81	4.4	141	7.6
22	8 05.5	8 06.8	7 43.4	22	1.2	82	4.4	142	7.7
23	8 05.8	8 07.1	7 43.6	23	1.2	83	4.5	143	7.7
24	8 06.0	8 07.3	7 43.9	24	1.3	84	4.6	144	7.8
25	8 06.3	8 07.6	7 44.1	25	1.4	85	4.6	145	7.9
26	8 06.5	8 07.8	7 44.3	26	1.4	86	4.7	146	7.9
27	8 06.8	8 08.1	7 44.6	27	1.5	87	4.7	147	8.0
28	8 07.0	8 08.3	7 44.8	28	1.5	88	4.8	148	8.0
29	8 07.3	8 08.6	7 45.1	29	1.6	89	4.8	149	8.1
30	8 07.5	8 08.8	7 45.3	30	1.6	90	4.9	150	8.1
31	8 07.8	8 09.1	7 45.5	31	1.7	91	4.9	151	8.2
32	8 08.0	8 09.3	7 45.8	32	1.7	92	5.0	152	8.2
33	8 08.3	8 09.6	7 46.0	33	1.8	93	5.0	153	8.3
34	8 08.5	8 09.8	7 46.2	34	1.8	94	5.1	154	8.3
35	8 08.8	8 10.1	7 46.5	35	1.9	95	5.1	155	8.4
36	8 09.0	8 10.3	7 46.7	36	2.0	96	5.2	156	8.5
37	8 09.3	8 10.6	7 47.0	37	2.0	97	5.3	157	8.5
38	8 09.5	8 10.8	7 47.2	38	2.1	98	5.3	158	8.6
39	8 09.8	8 11.1	7 47.4	39	2.1	99	5.4	159	8.6
40	8 10.0	8 11.3	7 47.7	40	2.2	100	5.4	160	8.7
41	8 10.3	8 11.6	7 47.9	41	2.2	101	5.5	161	8.7
42	8 10.5	8 11.8	7 48.2	42	2.3	102	5.5	162	8.8
43	8 10.8	8 12.1	7 48.4	43	2.3	103	5.6	163	8.8
44	8 11.0	8 12.3	7 48.6	44	2.4	104	5.6	164	8.9
45	8 11.3	8 12.6	7 48.9	45	2.4	105	5.7	165	8.9
46	8 11.5	8 12.8	7 49.1	46	2.5	106	5.7	166	9.0
47	8 11.8	8 13.1	7 49.3	47	2.5	107	5.8	167	9.0
48	8 12.0	8 13.3	7 49.6	48	2.6	108	5.9	168	9.1
49	8 12.3	8 13.6	7 49.8	49	2.7	109	5.9	169	9.2
50	8 12.5	8 13.8	7 50.1	50	2.7	110	6.0	170	9.2
51	8 12.8	8 14.1	7 50.3	51	2.8	111	6.0	171	9.3
52	8 13.0	8 14.3	7 50.5	52	2.8	112	6.1	172	9.3
53	8 13.3	8 14.6	7 50.8	53	2.9	113	6.1	173	9.4
54	8 13.5	8 14.9	7 51.0	54	2.9	114	6.2	174	9.4
55	8 13.8	8 15.1	7 51.3	55	3.0	115	6.2	175	9.5
56	8 14.0	8 15.4	7 51.5	56	3.0	116	6.3	176	9.5
57	8 14.3	8 15.6	7 51.7	57	3.1	117	6.3	177	9.6
58	8 14.5	8 15.9	7 52.0	58	3.1	118	6.4	178	9.6
59	8 14.8	8 16.1	7 52.2	59	3.2	119	6.4	179	9.7
60	8 15.0	8 16.4	7 52.5	60	3.3	120	6.5	180	9.8

33m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	8 15.0	8 16.4	7 52.5	0	0.0	60	3.4	120	6.7
1	8 15.3	8 16.6	7 52.7	1	0.1	61	3.4	121	6.8
2	8 15.5	8 16.9	7 52.9	2	0.1	62	3.5	122	6.8
3	8 15.8	8 17.1	7 53.2	3	0.2	63	3.5	123	6.9
4	8 16.0	8 17.4	7 53.4	4	0.2	64	3.6	124	6.9
5	8 16.3	8 17.6	7 53.6	5	0.3	65	3.6	125	7.0
6	8 16.5	8 17.9	7 53.9	6	0.3	66	3.7	126	7.0
7	8 16.8	8 18.1	7 54.1	7	0.4	67	3.7	127	7.1
8	8 17.0	8 18.4	7 54.4	8	0.4	68	3.8	128	7.1
9	8 17.3	8 18.6	7 54.6	9	0.5	69	3.9	129	7.2
10	8 17.5	8 18.9	7 54.8	10	0.6	70	3.9	130	7.3
11	8 17.8	8 19.1	7 55.1	11	0.6	71	4.0	131	7.3
12	8 18.0	8 19.4	7 55.3	12	0.7	72	4.0	132	7.4
13	8 18.3	8 19.6	7 55.6	13	0.7	73	4.1	133	7.4
14	8 18.5	8 19.9	7 55.8	14	0.8	74	4.1	134	7.5
15	8 18.8	8 20.1	7 56.0	15	0.8	75	4.2	135	7.5
16	8 19.0	8 20.4	7 56.3	16	0.9	76	4.2	136	7.6
17	8 19.3	8 20.6	7 56.5	17	0.9	77	4.3	137	7.6
18	8 19.5	8 20.9	7 56.7	18	1.0	78	4.4	138	7.7
19	8 19.8	8 21.1	7 57.0	19	1.1	79	4.4	139	7.8
20	8 20.0	8 21.4	7 57.2	20	1.1	80	4.5	140	7.8
21	8 20.3	8 21.6	7 57.5	21	1.2	81	4.5	141	7.9
22	8 20.5	8 21.9	7 57.7	22	1.2	82	4.6	142	7.9
23	8 20.8	8 22.1	7 57.9	23	1.3	83	4.6	143	8.0
24	8 21.0	8 22.4	7 58.2	24	1.3	84	4.7	144	8.0
25	8 21.3	8 22.6	7 58.4	25	1.4	85	4.7	145	8.1
26	8 21.5	8 22.9	7 58.7	26	1.5	86	4.8	146	8.2
27	8 21.8	8 23.1	7 58.9	27	1.5	87	4.9	147	8.2
28	8 22.0	8 23.4	7 59.1	28	1.6	88	4.9	148	8.3
29	8 22.3	8 23.6	7 59.4	29	1.6	89	5.0	149	8.3
30	8 22.5	8 23.9	7 59.6	30	1.7	90	5.0	150	8.4
31	8 22.8	8 24.1	7 59.8	31	1.7	91	5.1	151	8.4
32	8 23.0	8 24.4	8 00.1	32	1.8	92	5.1	152	8.5
33	8 23.3	8 24.6	8 00.3	33	1.8	93	5.2	153	8.5
34	8 23.5	8 24.9	8 00.6	34	1.9	94	5.2	154	8.6
35	8 23.8	8 25.1	8 00.8	35	2.0	95	5.3	155	8.7
36	8 24.0	8 25.4	8 01.0	36	2.0	96	5.4	156	8.7
37	8 24.3	8 25.6	8 01.3	37	2.1	97	5.4	157	8.8
38	8 24.5	8 25.9	8 01.5	38	2.1	98	5.5	158	8.8
39	8 24.8	8 26.1	8 01.8	39	2.2	99	5.5	159	8.9
40	8 25.0	8 26.4	8 02.0	40	2.2	100	5.6	160	8.9
41	8 25.3	8 26.6	8 02.2	41	2.3	101	5.6	161	9.0
42	8 25.5	8 26.9	8 02.5	42	2.3	102	5.7	162	9.0
43	8 25.8	8 27.1	8 02.7	43	2.4	103	5.8	163	9.1
44	8 26.0	8 27.4	8 02.9	44	2.5	104	5.8	164	9.2
45	8 26.3	8 27.6	8 03.2	45	2.5	105	5.9	165	9.2
46	8 26.5	8 27.9	8 03.4	46	2.6	106	5.9	166	9.3
47	8 26.8	8 28.1	8 03.7	47	2.6	107	6.0	167	9.3
48	8 27.0	8 28.4	8 03.9	48	2.7	108	6.0	168	9.4
49	8 27.3	8 28.6	8 04.1	49	2.7	109	6.1	169	9.4
50	8 27.5	8 28.9	8 04.4	50	2.8	110	6.1	170	9.5
51	8 27.8	8 29.1	8 04.6	51	2.8	111	6.2	171	9.5
52	8 28.0	8 29.4	8 04.9	52	2.9	112	6.3	172	9.6
53	8 28.3	8 29.6	8 05.1	53	3.0	113	6.3	173	9.7
54	8 28.5	8 29.9	8 05.3	54	3.0	114	6.4	174	9.7
55	8 28.8	8 30.1	8 05.6	55	3.1	115	6.4	175	9.8
56	8 29.0	8 30.4	8 05.8	56	3.1	116	6.5	176	9.8
57	8 29.3	8 30.6	8 06.1	57	3.2	117	6.5	177	9.9
58	8 29.5	8 30.9	8 06.3	58	3.2	118	6.6	178	9.9
59	8 29.8	8 31.1	8 06.5	59	3.3	119	6.6	179	10.0
60	8 30.0	8 31.4	8 06.8	60	3.4	120	6.7	180	10.1

34m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	8 30.0	8 31.4	8 06.8	0	0.0	60	3.5	120	6.9
1	8 30.3	8 31.6	8 07.0	1	0.1	61	3.5	121	7.0
2	8 30.5	8 31.9	8 07.2	2	0.1	62	3.6	122	7.0
3	8 30.8	8 32.1	8 07.5	3	0.2	63	3.6	123	7.1
4	8 31.0	8 32.4	8 07.7	4	0.2	64	3.7	124	7.1
5	8 31.3	8 32.6	8 08.0	5	0.3	65	3.7	125	7.2
6	8 31.5	8 32.9	8 08.2	6	0.3	66	3.8	126	7.2
7	8 31.8	8 33.2	8 08.4	7	0.4	67	3.9	127	7.3
8	8 32.0	8 33.4	8 08.7	8	0.5	68	3.9	128	7.4
9	8 32.3	8 33.7	8 08.9	9	0.5	69	4.0	129	7.4
10	8 32.5	8 33.9	8 09.2	10	0.6	70	4.0	130	7.5
11	8 32.8	8 34.2	8 09.4	11	0.6	71	4.1	131	7.5
12	8 33.0	8 34.4	8 09.6	12	0.7	72	4.1	132	7.6
13	8 33.3	8 34.7	8 09.9	13	0.7	73	4.2	133	7.6
14	8 33.5	8 34.9	8 10.1	14	0.8	74	4.3	134	7.7
15	8 33.8	8 35.2	8 10.3	15	0.9	75	4.3	135	7.8
16	8 34.0	8 35.4	8 10.6	16	0.9	76	4.4	136	7.8
17	8 34.3	8 35.7	8 10.8	17	1.0	77	4.4	137	7.9
18	8 34.5	8 35.9	8 11.1	18	1.0	78	4.5	138	7.9
19	8 34.8	8 36.2	8 11.3	19	1.1	79	4.5	139	8.0
20	8 35.0	8 36.4	8 11.5	20	1.2	80	4.6	140	8.1
21	8 35.3	8 36.7	8 11.8	21	1.2	81	4.7	141	8.1
22	8 35.5	8 36.9	8 12.0	22	1.3	82	4.7	142	8.2
23	8 35.8	8 37.2	8 12.3	23	1.3	83	4.8	143	8.2
24	8 36.0	8 37.4	8 12.5	24	1.4	84	4.8	144	8.3
25	8 36.3	8 37.7	8 12.7	25	1.4	85	4.9	145	8.3
26	8 36.5	8 37.9	8 13.0	26	1.5	86	4.9	146	8.4
27	8 36.8	8 38.2	8 13.2	27	1.6	87	5.0	147	8.5
28	8 37.0	8 38.4	8 13.4	28	1.6	88	5.1	148	8.5
29	8 37.3	8 38.7	8 13.7	29	1.7	89	5.1	149	8.6
30	8 37.5	8 38.9	8 13.9	30	1.7	90	5.2	150	8.6
31	8 37.8	8 39.2	8 14.2	31	1.8	91	5.2	151	8.7
32	8 38.0	8 39.4	8 14.4	32	1.8	92	5.3	152	8.7
33	8 38.3	8 39.7	8 14.6	33	1.9	93	5.3	153	8.8
34	8 38.5	8 39.9	8 14.9	34	2.0	94	5.4	154	8.9
35	8 38.8	8 40.2	8 15.1	35	2.0	95	5.5	155	8.9
36	8 39.0	8 40.4	8 15.4	36	2.1	96	5.5	156	9.0
37	8 39.3	8 40.7	8 15.6	37	2.1	97	5.6	157	9.0
38	8 39.5	8 40.9	8 15.8	38	2.2	98	5.6	158	9.1
39	8 39.8	8 41.2	8 16.1	39	2.2	99	5.7	159	9.1
40	8 40.0	8 41.4	8 16.3	40	2.3	100	5.8	160	9.2
41	8 40.3	8 41.7	8 16.5	41	2.4	101	5.8	161	9.3
42	8 40.5	8 41.9	8 16.8	42	2.4	102	5.9	162	9.3
43	8 40.8	8 42.2	8 17.0	43	2.5	103	5.9	163	9.4
44	8 41.0	8 42.4	8 17.3	44	2.5	104	6.0	164	9.4
45	8 41.3	8 42.7	8 17.5	45	2.6	105	6.0	165	9.5
46	8 41.5	8 42.9	8 17.7	46	2.6	106	6.1	166	9.5
47	8 41.8	8 43.2	8 18.0	47	2.7	107	6.2	167	9.6
48	8 42.0	8 43.4	8 18.2	48	2.8	108	6.2	168	9.7
49	8 42.3	8 43.7	8 18.5	49	2.8	109	6.3	169	9.7
50	8 42.5	8 43.9	8 18.7	50	2.9	110	6.3	170	9.8
51	8 42.8	8 44.2	8 18.9	51	2.9	111	6.4	171	9.8
52	8 43.0	8 44.4	8 19.2	52	3.0	112	6.4	172	9.9
53	8 43.3	8 44.7	8 19.4	53	3.0	113	6.5	173	9.9
54	8 43.5	8 44.9	8 19.7	54	3.1	114	6.6	174	10.0
55	8 43.8	8 45.2	8 19.9	55	3.2	115	6.6	175	10.1
56	8 44.0	8 45.4	8 20.1	56	3.2	116	6.7	176	10.1
57	8 44.3	8 45.7	8 20.4	57	3.3	117	6.7	177	10.2
58	8 44.5	8 45.9	8 20.6	58	3.3	118	6.8	178	10.2
59	8 44.8	8 46.2	8 20.8	59	3.4	119	6.8	179	10.3
60	8 45.0	8 46.4	8 21.1	60	3.5	120	6.9	180	10.4

35m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	8 45.0	8 46.4	8 21.1	0	0.0	60	3.6	120	7.1
1	8 45.3	8 46.7	8 21.3	1	0.1	61	3.6	121	7.2
2	8 45.5	8 46.9	8 21.6	2	0.1	62	3.7	122	7.2
3	8 45.8	8 47.2	8 21.8	3	0.2	63	3.7	123	7.3
4	8 46.0	8 47.4	8 22.0	4	0.2	64	3.8	124	7.3
5	8 46.3	8 47.7	8 22.3	5	0.3	65	3.8	125	7.4
6	8 46.5	8 47.9	8 22.5	6	0.4	66	3.9	126	7.5
7	8 46.8	8 48.2	8 22.8	7	0.4	67	4.0	127	7.5
8	8 47.0	8 48.4	8 23.0	8	0.5	68	4.0	128	7.6
9	8 47.3	8 48.7	8 23.2	9	0.5	69	4.1	129	7.6
10	8 47.5	8 48.9	8 23.5	10	0.6	70	4.1	130	7.7
11	8 47.8	8 49.2	8 23.7	11	0.7	71	4.2	131	7.8
12	8 48.0	8 49.4	8 23.9	12	0.7	72	4.3	132	7.8
13	8 48.3	8 49.7	8 24.2	13	0.8	73	4.3	133	7.9
14	8 48.5	8 49.9	8 24.4	14	0.8	74	4.4	134	7.9
15	8 48.8	8 50.2	8 24.7	15	0.9	75	4.4	135	8.0
16	8 49.0	8 50.4	8 24.9	16	0.9	76	4.5	136	8.0
17	8 49.3	8 50.7	8 25.1	17	1.0	77	4.6	137	8.1
18	8 49.5	8 50.9	8 25.4	18	1.1	78	4.6	138	8.2
19	8 49.8	8 51.2	8 25.6	19	1.1	79	4.7	139	8.2
20	8 50.0	8 51.5	8 25.9	20	1.2	80	4.7	140	8.3
21	8 50.3	8 51.7	8 26.1	21	1.2	81	4.8	141	8.3
22	8 50.5	8 52.0	8 26.3	22	1.3	82	4.9	142	8.4
23	8 50.8	8 52.2	8 26.6	23	1.4	83	4.9	143	8.5
24	8 51.0	8 52.5	8 26.8	24	1.4	84	5.0	144	8.5
25	8 51.3	8 52.7	8 27.0	25	1.5	85	5.0	145	8.6
26	8 51.5	8 53.0	8 27.3	26	1.5	86	5.1	146	8.6
27	8 51.8	8 53.2	8 27.5	27	1.6	87	5.1	147	8.7
28	8 52.0	8 53.5	8 27.8	28	1.7	88	5.2	148	8.8
29	8 52.3	8 53.7	8 28.0	29	1.7	89	5.3	149	8.8
30	8 52.5	8 54.0	8 28.2	30	1.8	90	5.3	150	8.9
31	8 52.8	8 54.2	8 28.5	31	1.8	91	5.4	151	8.9
32	8 53.0	8 54.5	8 28.7	32	1.9	92	5.4	152	9.0
33	8 53.3	8 54.7	8 29.0	33	2.0	93	5.5	153	9.1
34	8 53.5	8 55.0	8 29.2	34	2.0	94	5.6	154	9.1
35	8 53.8	8 55.2	8 29.4	35	2.1	95	5.6	155	9.2
36	8 54.0	8 55.5	8 29.7	36	2.1	96	5.7	156	9.2
37	8 54.3	8 55.7	8 29.9	37	2.2	97	5.7	157	9.3
38	8 54.5	8 56.0	8 30.2	38	2.2	98	5.8	158	9.3
39	8 54.8	8 56.2	8 30.4	39	2.3	99	5.9	159	9.4
40	8 55.0	8 56.5	8 30.6	40	2.4	100	5.9	160	9.5
41	8 55.3	8 56.7	8 30.9	41	2.4	101	6.0	161	9.5
42	8 55.5	8 57.0	8 31.1	42	2.5	102	6.0	162	9.6
43	8 55.8	8 57.2	8 31.3	43	2.5	103	6.1	163	9.6
44	8 56.0	8 57.5	8 31.6	44	2.6	104	6.2	164	9.7
45	8 56.3	8 57.7	8 31.8	45	2.7	105	6.2	165	9.8
46	8 56.5	8 58.0	8 32.1	46	2.7	106	6.3	166	9.8
47	8 56.8	8 58.2	8 32.3	47	2.8	107	6.3	167	9.9
48	8 57.0	8 58.5	8 32.5	48	2.8	108	6.4	168	9.9
49	8 57.3	8 58.7	8 32.8	49	2.9	109	6.4	169	10.0
50	8 57.5	8 59.0	8 33.0	50	3.0	110	6.5	170	10.1
51	8 57.8	8 59.2	8 33.3	51	3.0	111	6.6	171	10.1
52	8 58.0	8 59.5	8 33.5	52	3.1	112	6.6	172	10.2
53	8 58.3	8 59.7	8 33.7	53	3.1	113	6.7	173	10.2
54	8 58.5	9 00.0	8 34.0	54	3.2	114	6.7	174	10.3
55	8 58.8	9 00.2	8 34.2	55	3.3	115	6.8	175	10.4
56	8 59.0	9 00.5	8 34.4	56	3.3	116	6.9	176	10.4
57	8 59.3	9 00.7	8 34.7	57	3.4	117	6.9	177	10.5
58	8 59.5	9 01.0	8 34.9	58	3.4	118	7.0	178	10.5
59	8 59.8	9 01.2	8 35.2	59	3.5	119	7.0	179	10.6
60	9 00.0	9 01.5	8 35.4	60	3.6	120	7.1	180	10.7

36m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	9 00.0	9 01.5	8 35.4	0	0.0	60	3.7	120	7.3
1	9 00.3	9 01.7	8 35.6	1	0.1	61	3.7	121	7.4
2	9 00.5	9 02.0	8 35.9	2	0.1	62	3.8	122	7.4
3	9 00.8	9 02.2	8 36.1	3	0.2	63	3.8	123	7.5
4	9 01.0	9 02.5	8 36.4	4	0.2	64	3.9	124	7.5
5	9 01.3	9 02.7	8 36.6	5	0.3	65	4.0	125	7.6
6	9 01.5	9 03.0	8 36.8	6	0.4	66	4.0	126	7.7
7	9 01.8	9 03.2	8 37.1	7	0.4	67	4.1	127	7.7
8	9 02.0	9 03.5	8 37.3	8	0.5	68	4.1	128	7.8
9	9 02.3	9 03.7	8 37.5	9	0.5	69	4.2	129	7.8
10	9 02.5	9 04.0	8 37.8	10	0.6	70	4.3	130	7.9
11	9 02.8	9 04.2	8 38.0	11	0.7	71	4.3	131	8.0
12	9 03.0	9 04.5	8 38.3	12	0.7	72	4.4	132	8.0
13	9 03.3	9 04.7	8 38.5	13	0.8	73	4.4	133	8.1
14	9 03.5	9 05.0	8 38.7	14	0.9	74	4.5	134	8.2
15	9 03.8	9 05.2	8 39.0	15	0.9	75	4.6	135	8.2
16	9 04.0	9 05.5	8 39.2	16	1.0	76	4.6	136	8.3
17	9 04.3	9 05.7	8 39.5	17	1.0	77	4.7	137	8.3
18	9 04.5	9 06.0	8 39.7	18	1.1	78	4.7	138	8.4
19	9 04.8	9 06.2	8 39.9	19	1.2	79	4.8	139	8.5
20	9 05.0	9 06.5	8 40.2	20	1.2	80	4.9	140	8.5
21	9 05.3	9 06.7	8 40.4	21	1.3	81	4.9	141	8.6
22	9 05.5	9 07.0	8 40.6	22	1.3	82	5.0	142	8.6
23	9 05.8	9 07.2	8 40.9	23	1.4	83	5.0	143	8.7
24	9 06.0	9 07.5	8 41.1	24	1.5	84	5.1	144	8.8
25	9 06.3	9 07.7	8 41.4	25	1.5	85	5.2	145	8.8
26	9 06.5	9 08.0	8 41.6	26	1.6	86	5.2	146	8.9
27	9 06.8	9 08.2	8 41.8	27	1.6	87	5.3	147	8.9
28	9 07.0	9 08.5	8 42.1	28	1.7	88	5.4	148	9.0
29	9 07.3	9 08.7	8 42.3	29	1.8	89	5.4	149	9.1
30	9 07.5	9 09.0	8 42.6	30	1.8	90	5.5	150	9.1
31	9 07.8	9 09.2	8 42.8	31	1.9	91	5.5	151	9.2
32	9 08.0	9 09.5	8 43.0	32	1.9	92	5.6	152	9.2
33	9 08.3	9 09.8	8 43.3	33	2.0	93	5.7	153	9.3
34	9 08.5	9 10.0	8 43.5	34	2.1	94	5.7	154	9.4
35	9 08.8	9 10.3	8 43.8	35	2.1	95	5.8	155	9.4
36	9 09.0	9 10.5	8 44.0	36	2.2	96	5.8	156	9.5
37	9 09.3	9 10.8	8 44.2	37	2.3	97	5.9	157	9.6
38	9 09.5	9 11.0	8 44.5	38	2.3	98	6.0	158	9.6
39	9 09.8	9 11.3	8 44.7	39	2.4	99	6.0	159	9.7
40	9 10.0	9 11.5	8 44.9	40	2.4	100	6.1	160	9.7
41	9 10.3	9 11.8	8 45.2	41	2.5	101	6.1	161	9.8
42	9 10.5	9 12.0	8 45.4	42	2.6	102	6.2	162	9.9
43	9 10.8	9 12.3	8 45.7	43	2.6	103	6.3	163	9.9
44	9 11.0	9 12.5	8 45.9	44	2.7	104	6.3	164	10.0
45	9 11.3	9 12.8	8 46.1	45	2.7	105	6.4	165	10.0
46	9 11.5	9 13.0	8 46.4	46	2.8	106	6.4	166	10.1
47	9 11.8	9 13.3	8 46.6	47	2.9	107	6.5	167	10.2
48	9 12.0	9 13.5	8 46.9	48	2.9	108	6.6	168	10.2
49	9 12.3	9 13.8	8 47.1	49	3.0	109	6.6	169	10.3
50	9 12.5	9 14.0	8 47.3	50	3.0	110	6.7	170	10.3
51	9 12.8	9 14.3	8 47.6	51	3.1	111	6.8	171	10.4
52	9 13.0	9 14.5	8 47.8	52	3.2	112	6.8	172	10.5
53	9 13.3	9 14.8	8 48.0	53	3.2	113	6.9	173	10.5
54	9 13.5	9 15.0	8 48.3	54	3.3	114	6.9	174	10.6
55	9 13.8	9 15.3	8 48.5	55	3.3	115	7.0	175	10.6
56	9 14.0	9 15.5	8 48.8	56	3.4	116	7.1	176	10.7
57	9 14.3	9 15.8	8 49.0	57	3.5	117	7.1	177	10.8
58	9 14.5	9 16.0	8 49.2	58	3.5	118	7.2	178	10.8
59	9 14.8	9 16.3	8 49.5	59	3.6	119	7.2	179	10.9
60	9 15.0	9 16.5	8 49.7	60	3.7	120	7.3	180	11.0

37m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	9 15.0	9 16.5	8 49.7	0	0.0	60	3.8	120	7.5
1	9 15.3	9 16.8	8 50.0	1	0.1	61	3.8	121	7.6
2	9 15.5	9 17.0	8 50.2	2	0.1	62	3.9	122	7.6
3	9 15.8	9 17.3	8 50.4	3	0.2	63	3.9	123	7.7
4	9 16.0	9 17.5	8 50.7	4	0.3	64	4.0	124	7.8
5	9 16.3	9 17.8	8 50.9	5	0.3	65	4.1	125	7.8
6	9 16.5	9 18.0	8 51.1	6	0.4	66	4.1	126	7.9
7	9 16.8	9 18.3	8 51.4	7	0.4	67	4.2	127	7.9
8	9 17.0	9 18.5	8 51.6	8	0.5	68	4.3	128	8.0
9	9 17.3	9 18.8	8 51.9	9	0.6	69	4.3	129	8.1
10	9 17.5	9 19.0	8 52.1	10	0.6	70	4.4	130	8.1
11	9 17.8	9 19.3	8 52.3	11	0.7	71	4.4	131	8.2
12	9 18.0	9 19.5	8 52.6	12	0.8	72	4.5	132	8.3
13	9 18.3	9 19.8	8 52.8	13	0.8	73	4.6	133	8.3
14	9 18.5	9 20.0	8 53.1	14	0.9	74	4.6	134	8.4
15	9 18.8	9 20.3	8 53.3	15	0.9	75	4.7	135	8.4
16	9 19.0	9 20.5	8 53.5	16	1.0	76	4.8	136	8.5
17	9 19.3	9 20.8	8 53.8	17	1.1	77	4.8	137	8.6
18	9 19.5	9 21.0	8 54.0	18	1.1	78	4.9	138	8.6
19	9 19.8	9 21.3	8 54.3	19	1.2	79	4.9	139	8.7
20	9 20.0	9 21.5	8 54.5	20	1.3	80	5.0	140	8.8
21	9 20.3	9 21.8	8 54.7	21	1.3	81	5.1	141	8.8
22	9 20.5	9 22.0	8 55.0	22	1.4	82	5.1	142	8.9
23	9 20.8	9 22.3	8 55.2	23	1.4	83	5.2	143	8.9
24	9 21.0	9 22.5	8 55.4	24	1.5	84	5.3	144	9.0
25	9 21.3	9 22.8	8 55.7	25	1.6	85	5.3	145	9.1
26	9 21.5	9 23.0	8 55.9	26	1.6	86	5.4	146	9.1
27	9 21.8	9 23.3	8 56.2	27	1.7	87	5.4	147	9.2
28	9 22.0	9 23.5	8 56.4	28	1.8	88	5.5	148	9.3
29	9 22.3	9 23.8	8 56.6	29	1.8	89	5.6	149	9.3
30	9 22.5	9 24.0	8 56.9	30	1.9	90	5.6	150	9.4
31	9 22.8	9 24.3	8 57.1	31	1.9	91	5.7	151	9.4
32	9 23.0	9 24.5	8 57.4	32	2.0	92	5.8	152	9.5
33	9 23.3	9 24.8	8 57.6	33	2.1	93	5.8	153	9.6
34	9 23.5	9 25.0	8 57.8	34	2.1	94	5.9	154	9.6
35	9 23.8	9 25.3	8 58.1	35	2.2	95	5.9	155	9.7
36	9 24.0	9 25.5	8 58.3	36	2.3	96	6.0	156	9.8
37	9 24.3	9 25.8	8 58.5	37	2.3	97	6.1	157	9.8
38	9 24.5	9 26.0	8 58.8	38	2.4	98	6.1	158	9.9
39	9 24.8	9 26.3	8 59.0	39	2.4	99	6.2	159	9.9
40	9 25.0	9 26.5	8 59.3	40	2.5	100	6.3	160	10.0
41	9 25.3	9 26.8	8 59.5	41	2.6	101	6.3	161	10.1
42	9 25.5	9 27.0	8 59.7	42	2.6	102	6.4	162	10.1
43	9 25.8	9 27.3	9 00.0	43	2.7	103	6.4	163	10.2
44	9 26.0	9 27.5	9 00.2	44	2.8	104	6.5	164	10.3
45	9 26.3	9 27.8	9 00.5	45	2.8	105	6.6	165	10.3
46	9 26.5	9 28.1	9 00.7	46	2.9	106	6.6	166	10.4
47	9 26.8	9 28.3	9 00.9	47	2.9	107	6.7	167	10.4
48	9 27.0	9 28.6	9 01.2	48	3.0	108	6.8	168	10.5
49	9 27.3	9 28.8	9 01.4	49	3.1	109	6.8	169	10.6
50	9 27.5	9 29.1	9 01.6	50	3.1	110	6.9	170	10.6
51	9 27.8	9 29.3	9 01.9	51	3.2	111	6.9	171	10.7
52	9 28.0	9 29.6	9 02.1	52	3.3	112	7.0	172	10.8
53	9 28.3	9 29.8	9 02.4	53	3.3	113	7.1	173	10.8
54	9 28.5	9 30.1	9 02.6	54	3.4	114	7.1	174	10.9
55	9 28.8	9 30.3	9 02.8	55	3.4	115	7.2	175	10.9
56	9 29.0	9 30.6	9 03.1	56	3.5	116	7.3	176	11.0
57	9 29.3	9 30.8	9 03.3	57	3.6	117	7.3	177	11.1
58	9 29.5	9 31.1	9 03.6	58	3.6	118	7.4	178	11.1
59	9 29.8	9 31.3	9 03.8	59	3.7	119	7.4	179	11.2
60	9 30.0	9 31.6	9 04.0	60	3.8	120	7.5	180	11.3

38m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	9 30.0	9 31.6	9 04.0	0	0.0	60	3.9	120	7.7
1	9 30.3	9 31.8	9 04.3	1	0.1	61	3.9	121	7.8
2	9 30.5	9 32.1	9 04.5	2	0.1	62	4.0	122	7.8
3	9 30.8	9 32.3	9 04.7	3	0.2	63	4.0	123	7.9
4	9 31.0	9 32.6	9 05.0	4	0.3	64	4.1	124	8.0
5	9 31.3	9 32.8	9 05.2	5	0.3	65	4.2	125	8.0
6	9 31.5	9 33.1	9 05.5	6	0.4	66	4.2	126	8.1
7	9 31.8	9 33.3	9 05.7	7	0.4	67	4.3	127	8.1
8	9 32.0	9 33.6	9 05.9	8	0.5	68	4.4	128	8.2
9	9 32.3	9 33.8	9 06.2	9	0.6	69	4.4	129	8.3
10	9 32.5	9 34.1	9 06.4	10	0.6	70	4.5	130	8.3
11	9 32.8	9 34.3	9 06.7	11	0.7	71	4.6	131	8.4
12	9 33.0	9 34.6	9 06.9	12	0.8	72	4.6	132	8.5
13	9 33.3	9 34.8	9 07.1	13	0.8	73	4.7	133	8.5
14	9 33.5	9 35.1	9 07.4	14	0.9	74	4.7	134	8.6
15	9 33.8	9 35.3	9 07.6	15	1.0	75	4.8	135	8.7
16	9 34.0	9 35.6	9 07.9	16	1.0	76	4.9	136	8.7
17	9 34.3	9 35.8	9 08.1	17	1.1	77	4.9	137	8.8
18	9 34.5	9 36.1	9 08.3	18	1.2	78	5.0	138	8.9
19	9 34.8	9 36.3	9 08.6	19	1.2	79	5.1	139	8.9
20	9 35.0	9 36.6	9 08.8	20	1.3	80	5.1	140	9.0
21	9 35.3	9 36.8	9 09.0	21	1.3	81	5.2	141	9.0
22	9 35.5	9 37.1	9 09.3	22	1.4	82	5.3	142	9.1
23	9 35.8	9 37.3	9 09.5	23	1.5	83	5.3	143	9.2
24	9 36.0	9 37.6	9 09.8	24	1.5	84	5.4	144	9.2
25	9 36.3	9 37.8	9 10.0	25	1.6	85	5.5	145	9.3
26	9 36.5	9 38.1	9 10.2	26	1.7	86	5.5	146	9.4
27	9 36.8	9 38.3	9 10.5	27	1.7	87	5.6	147	9.4
28	9 37.0	9 38.6	9 10.7	28	1.8	88	5.6	148	9.5
29	9 37.3	9 38.8	9 11.0	29	1.9	89	5.7	149	9.6
30	9 37.5	9 39.1	9 11.2	30	1.9	90	5.8	150	9.6
31	9 37.8	9 39.3	9 11.4	31	2.0	91	5.8	151	9.7
32	9 38.0	9 39.6	9 11.7	32	2.1	92	5.9	152	9.8
33	9 38.3	9 39.8	9 11.9	33	2.1	93	6.0	153	9.8
34	9 38.5	9 40.1	9 12.1	34	2.2	94	6.0	154	9.9
35	9 38.8	9 40.3	9 12.4	35	2.2	95	6.1	155	9.9
36	9 39.0	9 40.6	9 12.6	36	2.3	96	6.2	156	10.0
37	9 39.3	9 40.8	9 12.9	37	2.4	97	6.2	157	10.1
38	9 39.5	9 41.1	9 13.1	38	2.4	98	6.3	158	10.1
39	9 39.8	9 41.3	9 13.3	39	2.5	99	6.4	159	10.2
40	9 40.0	9 41.6	9 13.6	40	2.6	100	6.4	160	10.3
41	9 40.3	9 41.8	9 13.8	41	2.6	101	6.5	161	10.3
42	9 40.5	9 42.1	9 14.1	42	2.7	102	6.5	162	10.4
43	9 40.8	9 42.3	9 14.3	43	2.8	103	6.6	163	10.5
44	9 41.0	9 42.6	9 14.5	44	2.8	104	6.7	164	10.5
45	9 41.3	9 42.8	9 14.8	45	2.9	105	6.7	165	10.6
46	9 41.5	9 43.1	9 15.0	46	3.0	106	6.8	166	10.7
47	9 41.8	9 43.3	9 15.2	47	3.0	107	6.9	167	10.7
48	9 42.0	9 43.6	9 15.5	48	3.1	108	6.9	168	10.8
49	9 42.3	9 43.8	9 15.7	49	3.1	109	7.0	169	10.8
50	9 42.5	9 44.1	9 16.0	50	3.2	110	7.1	170	10.9
51	9 42.8	9 44.3	9 16.2	51	3.3	111	7.1	171	11.0
52	9 43.0	9 44.6	9 16.4	52	3.3	112	7.2	172	11.0
53	9 43.3	9 44.8	9 16.7	53	3.4	113	7.3	173	11.1
54	9 43.5	9 45.1	9 16.9	54	3.5	114	7.3	174	11.2
55	9 43.8	9 45.3	9 17.2	55	3.5	115	7.4	175	11.2
56	9 44.0	9 45.6	9 17.4	56	3.6	116	7.4	176	11.3
57	9 44.3	9 45.8	9 17.6	57	3.7	117	7.5	177	11.4
58	9 44.5	9 46.1	9 17.9	58	3.7	118	7.6	178	11.4
59	9 44.8	9 46.4	9 18.1	59	3.8	119	7.6	179	11.5
60	9 45.0	9 46.6	9 18.4	60	3.9	120	7.7	180	11.6

39m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	9 45.0	9 46.6	9 18.4	0	0.0	60	4.0	120	7.9
1	9 45.3	9 46.9	9 18.6	1	0.1	61	4.0	121	8.0
2	9 45.5	9 47.1	9 18.8	2	0.1	62	4.1	122	8.0
3	9 45.8	9 47.4	9 19.1	3	0.2	63	4.1	123	8.1
4	9 46.0	9 47.6	9 19.3	4	0.3	64	4.2	124	8.2
5	9 46.3	9 47.9	9 19.5	5	0.3	65	4.3	125	8.2
6	9 46.5	9 48.1	9 19.8	6	0.4	66	4.3	126	8.3
7	9 46.8	9 48.4	9 20.0	7	0.5	67	4.4	127	8.4
8	9 47.0	9 48.6	9 20.3	8	0.5	68	4.5	128	8.4
9	9 47.3	9 48.9	9 20.5	9	0.6	69	4.5	129	8.5
10	9 47.5	9 49.1	9 20.7	10	0.7	70	4.6	130	8.6
11	9 47.8	9 49.4	9 21.0	11	0.7	71	4.7	131	8.6
12	9 48.0	9 49.6	9 21.2	12	0.8	72	4.7	132	8.7
13	9 48.3	9 49.9	9 21.5	13	0.9	73	4.8	133	8.8
14	9 48.5	9 50.1	9 21.7	14	0.9	74	4.9	134	8.8
15	9 48.8	9 50.4	9 21.9	15	1.0	75	4.9	135	8.9
16	9 49.0	9 50.6	9 22.2	16	1.1	76	5.0	136	9.0
17	9 49.3	9 50.9	9 22.4	17	1.1	77	5.1	137	9.0
18	9 49.5	9 51.1	9 22.6	18	1.2	78	5.1	138	9.1
19	9 49.8	9 51.4	9 22.9	19	1.3	79	5.2	139	9.2
20	9 50.0	9 51.6	9 23.1	20	1.3	80	5.3	140	9.2
21	9 50.3	9 51.9	9 23.4	21	1.4	81	5.3	141	9.3
22	9 50.5	9 52.1	9 23.6	22	1.4	82	5.4	142	9.3
23	9 50.8	9 52.4	9 23.8	23	1.5	83	5.5	143	9.4
24	9 51.0	9 52.6	9 24.1	24	1.6	84	5.5	144	9.5
25	9 51.3	9 52.9	9 24.3	25	1.6	85	5.6	145	9.5
26	9 51.5	9 53.1	9 24.6	26	1.7	86	5.7	146	9.6
27	9 51.8	9 53.4	9 24.8	27	1.8	87	5.7	147	9.7
28	9 52.0	9 53.6	9 25.0	28	1.8	88	5.8	148	9.7
29	9 52.3	9 53.9	9 25.3	29	1.9	89	5.9	149	9.8
30	9 52.5	9 54.1	9 25.5	30	2.0	90	5.9	150	9.9
31	9 52.8	9 54.4	9 25.7	31	2.0	91	6.0	151	9.9
32	9 53.0	9 54.6	9 26.0	32	2.1	92	6.1	152	10.0
33	9 53.3	9 54.9	9 26.2	33	2.2	93	6.1	153	10.1
34	9 53.5	9 55.1	9 26.5	34	2.2	94	6.2	154	10.1
35	9 53.8	9 55.4	9 26.7	35	2.3	95	6.3	155	10.2
36	9 54.0	9 55.6	9 26.9	36	2.4	96	6.3	156	10.3
37	9 54.3	9 55.9	9 27.2	37	2.4	97	6.4	157	10.3
38	9 54.5	9 56.1	9 27.4	38	2.5	98	6.5	158	10.4
39	9 54.8	9 56.4	9 27.7	39	2.6	99	6.5	159	10.5
40	9 55.0	9 56.6	9 27.9	40	2.6	100	6.6	160	10.5
41	9 55.3	9 56.9	9 28.1	41	2.7	101	6.6	161	10.6
42	9 55.5	9 57.1	9 28.4	42	2.8	102	6.7	162	10.7
43	9 55.8	9 57.4	9 28.6	43	2.8	103	6.8	163	10.7
44	9 56.0	9 57.6	9 28.8	44	2.9	104	6.8	164	10.8
45	9 56.3	9 57.9	9 29.1	45	3.0	105	6.9	165	10.9
46	9 56.5	9 58.1	9 29.3	46	3.0	106	7.0	166	10.9
47	9 56.8	9 58.4	9 29.6	47	3.1	107	7.0	167	11.0
48	9 57.0	9 58.6	9 29.8	48	3.2	108	7.1	168	11.1
49	9 57.3	9 58.9	9 30.0	49	3.2	109	7.2	169	11.1
50	9 57.5	9 59.1	9 30.3	50	3.3	110	7.2	170	11.2
51	9 57.8	9 59.4	9 30.5	51	3.4	111	7.3	171	11.3
52	9 58.0	9 59.6	9 30.8	52	3.4	112	7.4	172	11.3
53	9 58.3	9 59.9	9 31.0	53	3.5	113	7.4	173	11.4
54	9 58.5	10 00.1	9 31.2	54	3.6	114	7.5	174	11.5
55	9 58.8	10 00.4	9 31.5	55	3.6	115	7.6	175	11.5
56	9 59.0	10 00.6	9 31.7	56	3.7	116	7.6	176	11.6
57	9 59.3	10 00.9	9 32.0	57	3.8	117	7.7	177	11.7
58	9 59.5	10 01.1	9 32.2	58	3.8	118	7.8	178	11.7
59	9 59.8	10 01.4	9 32.4	59	3.9	119	7.8	179	11.8
60	10 00.0	10 01.6	9 32.7	60	4.0	120	7.9	180	11.9

40m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	10 00.0	10 01.6	9 32.7	0	0.0	60	4.1	120	8.1
1	10 00.3	10 01.9	9 32.9	1	0.1	61	4.1	121	8.2
2	10 00.5	10 02.1	9 33.1	2	0.1	62	4.2	122	8.2
3	10 00.8	10 02.4	9 33.4	3	0.2	63	4.3	123	8.3
4	10 01.0	10 02.6	9 33.6	4	0.3	64	4.3	124	8.4
5	10 01.3	10 02.9	9 33.9	5	0.3	65	4.4	125	8.4
6	10 01.5	10 03.1	9 34.1	6	0.4	66	4.5	126	8.5
7	10 01.8	10 03.4	9 34.3	7	0.5	67	4.5	127	8.6
8	10 02.0	10 03.6	9 34.6	8	0.5	68	4.6	128	8.6
9	10 02.3	10 03.9	9 34.8	9	0.6	69	4.7	129	8.7
10	10 02.5	10 04.1	9 35.1	10	0.7	70	4.7	130	8.8
11	10 02.8	10 04.4	9 35.3	11	0.7	71	4.8	131	8.8
12	10 03.0	10 04.7	9 35.5	12	0.8	72	4.9	132	8.9
13	10 03.3	10 04.9	9 35.8	13	0.9	73	4.9	133	9.0
14	10 03.5	10 05.2	9 36.0	14	0.9	74	5.0	134	9.0
15	10 03.8	10 05.4	9 36.2	15	1.0	75	5.1	135	9.1
16	10 04.0	10 05.7	9 36.5	16	1.1	76	5.1	136	9.2
17	10 04.3	10 05.9	9 36.7	17	1.1	77	5.2	137	9.2
18	10 04.5	10 06.2	9 37.0	18	1.2	78	5.3	138	9.3
19	10 04.8	10 06.4	9 37.2	19	1.3	79	5.3	139	9.4
20	10 05.0	10 06.7	9 37.4	20	1.4	80	5.4	140	9.5
21	10 05.3	10 06.9	9 37.7	21	1.4	81	5.5	141	9.5
22	10 05.5	10 07.2	9 37.9	22	1.5	82	5.5	142	9.6
23	10 05.8	10 07.4	9 38.2	23	1.6	83	5.6	143	9.7
24	10 06.0	10 07.7	9 38.4	24	1.6	84	5.7	144	9.7
25	10 06.3	10 07.9	9 38.6	25	1.7	85	5.7	145	9.8
26	10 06.5	10 08.2	9 38.9	26	1.8	86	5.8	146	9.9
27	10 06.8	10 08.4	9 39.1	27	1.8	87	5.9	147	9.9
28	10 07.0	10 08.7	9 39.3	28	1.9	88	5.9	148	10.0
29	10 07.3	10 08.9	9 39.6	29	2.0	89	6.0	149	10.1
30	10 07.5	10 09.2	9 39.8	30	2.0	90	6.1	150	10.1
31	10 07.8	10 09.4	9 40.1	31	2.1	91	6.1	151	10.2
32	10 08.0	10 09.7	9 40.3	32	2.2	92	6.2	152	10.3
33	10 08.3	10 09.9	9 40.5	33	2.2	93	6.3	153	10.3
34	10 08.5	10 10.2	9 40.8	34	2.3	94	6.3	154	10.4
35	10 08.8	10 10.4	9 41.0	35	2.4	95	6.4	155	10.5
36	10 09.0	10 10.7	9 41.3	36	2.4	96	6.5	156	10.5
37	10 09.3	10 10.9	9 41.5	37	2.5	97	6.5	157	10.6
38	10 09.5	10 11.2	9 41.7	38	2.6	98	6.6	158	10.7
39	10 09.8	10 11.4	9 42.0	39	2.6	99	6.7	159	10.7
40	10 10.0	10 11.7	9 42.2	40	2.7	100	6.8	160	10.8
41	10 10.3	10 11.9	9 42.4	41	2.8	101	6.8	161	10.9
42	10 10.5	10 12.2	9 42.7	42	2.8	102	6.9	162	10.9
43	10 10.8	10 12.4	9 42.9	43	2.9	103	7.0	163	11.0
44	10 11.0	10 12.7	9 43.2	44	3.0	104	7.0	164	11.1
45	10 11.3	10 12.9	9 43.4	45	3.0	105	7.1	165	11.1
46	10 11.5	10 13.2	9 43.6	46	3.1	106	7.2	166	11.2
47	10 11.8	10 13.4	9 43.9	47	3.2	107	7.2	167	11.3
48	10 12.0	10 13.7	9 44.1	48	3.2	108	7.3	168	11.3
49	10 12.3	10 13.9	9 44.4	49	3.3	109	7.4	169	11.4
50	10 12.5	10 14.2	9 44.6	50	3.4	110	7.4	170	11.5
51	10 12.8	10 14.4	9 44.8	51	3.4	111	7.5	171	11.5
52	10 13.0	10 14.7	9 45.1	52	3.5	112	7.6	172	11.6
53	10 13.3	10 14.9	9 45.3	53	3.6	113	7.6	173	11.7
54	10 13.5	10 15.2	9 45.6	54	3.6	114	7.7	174	11.7
55	10 13.8	10 15.4	9 45.8	55	3.7	115	7.8	175	11.8
56	10 14.0	10 15.7	9 46.0	56	3.8	116	7.8	176	11.9
57	10 14.3	10 15.9	9 46.3	57	3.8	117	7.9	177	11.9
58	10 14.5	10 16.2	9 46.5	58	3.9	118	8.0	178	12.0
59	10 14.8	10 16.4	9 46.7	59	4.0	119	8.0	179	12.1
60	10 15.0	10 16.7	9 47.0	60	4.1	120	8.1	180	12.2

41m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	10 15.0	10 16.7	9 47.0	0	0.0	60	4.2	120	8.3
1	10 15.3	10 16.9	9 47.2	1	0.1	61	4.2	121	8.4
2	10 15.5	10 17.2	9 47.5	2	0.1	62	4.3	122	8.4
3	10 15.8	10 17.4	9 47.7	3	0.2	63	4.4	123	8.5
4	10 16.0	10 17.7	9 47.9	4	0.3	64	4.4	124	8.6
5	10 16.3	10 17.9	9 48.2	5	0.3	65	4.5	125	8.6
6	10 16.5	10 18.2	9 48.4	6	0.4	66	4.6	126	8.7
7	10 16.8	10 18.4	9 48.7	7	0.5	67	4.6	127	8.8
8	10 17.0	10 18.7	9 48.9	8	0.6	68	4.7	128	8.9
9	10 17.3	10 18.9	9 49.1	9	0.6	69	4.8	129	8.9
10	10 17.5	10 19.2	9 49.4	10	0.7	70	4.8	130	9.0
11	10 17.8	10 19.4	9 49.6	11	0.8	71	4.9	131	9.1
12	10 18.0	10 19.7	9 49.8	12	0.8	72	5.0	132	9.1
13	10 18.3	10 19.9	9 50.1	13	0.9	73	5.0	133	9.2
14	10 18.5	10 20.2	9 50.3	14	1.0	74	5.1	134	9.3
15	10 18.8	10 20.4	9 50.6	15	1.0	75	5.2	135	9.3
16	10 19.0	10 20.7	9 50.8	16	1.1	76	5.3	136	9.4
17	10 19.3	10 20.9	9 51.0	17	1.2	77	5.3	137	9.5
18	10 19.5	10 21.2	9 51.3	18	1.2	78	5.4	138	9.5
19	10 19.8	10 21.4	9 51.5	19	1.3	79	5.5	139	9.6
20	10 20.0	10 21.7	9 51.8	20	1.4	80	5.5	140	9.7
21	10 20.3	10 21.9	9 52.0	21	1.5	81	5.6	141	9.8
22	10 20.5	10 22.2	9 52.2	22	1.5	82	5.7	142	9.8
23	10 20.8	10 22.4	9 52.5	23	1.6	83	5.7	143	9.9
24	10 21.0	10 22.7	9 52.7	24	1.7	84	5.8	144	10.0
25	10 21.3	10 23.0	9 52.9	25	1.7	85	5.9	145	10.0
26	10 21.5	10 23.2	9 53.2	26	1.8	86	5.9	146	10.1
27	10 21.8	10 23.5	9 53.4	27	1.9	87	6.0	147	10.2
28	10 22.0	10 23.7	9 53.7	28	1.9	88	6.1	148	10.2
29	10 22.3	10 24.0	9 53.9	29	2.0	89	6.2	149	10.3
30	10 22.5	10 24.2	9 54.1	30	2.1	90	6.2	150	10.4
31	10 22.8	10 24.5	9 54.4	31	2.1	91	6.3	151	10.4
32	10 23.0	10 24.7	9 54.6	32	2.2	92	6.4	152	10.5
33	10 23.3	10 25.0	9 54.9	33	2.3	93	6.4	153	10.6
34	10 23.5	10 25.2	9 55.1	34	2.4	94	6.5	154	10.7
35	10 23.8	10 25.5	9 55.3	35	2.4	95	6.6	155	10.7
36	10 24.0	10 25.7	9 55.6	36	2.5	96	6.6	156	10.8
37	10 24.3	10 26.0	9 55.8	37	2.6	97	6.7	157	10.9
38	10 24.5	10 26.2	9 56.1	38	2.6	98	6.8	158	10.9
39	10 24.8	10 26.5	9 56.3	39	2.7	99	6.8	159	11.0
40	10 25.0	10 26.7	9 56.5	40	2.8	100	6.9	160	11.1
41	10 25.3	10 27.0	9 56.8	41	2.8	101	7.0	161	11.1
42	10 25.5	10 27.2	9 57.0	42	2.9	102	7.1	162	11.2
43	10 25.8	10 27.5	9 57.2	43	3.0	103	7.1	163	11.3
44	10 26.0	10 27.7	9 57.5	44	3.0	104	7.2	164	11.3
45	10 26.3	10 28.0	9 57.7	45	3.1	105	7.3	165	11.4
46	10 26.5	10 28.2	9 58.0	46	3.2	106	7.3	166	11.5
47	10 26.8	10 28.5	9 58.2	47	3.3	107	7.4	167	11.6
48	10 27.0	10 28.7	9 58.4	48	3.3	108	7.5	168	11.6
49	10 27.3	10 29.0	9 58.7	49	3.4	109	7.5	169	11.7
50	10 27.5	10 29.2	9 58.9	50	3.5	110	7.6	170	11.8
51	10 27.8	10 29.5	9 59.2	51	3.5	111	7.7	171	11.8
52	10 28.0	10 29.7	9 59.4	52	3.6	112	7.7	172	11.9
53	10 28.3	10 30.0	9 59.6	53	3.7	113	7.8	173	12.0
54	10 28.5	10 30.2	9 59.9	54	3.7	114	7.9	174	12.0
55	10 28.8	10 30.5	10 00.1	55	3.8	115	8.0	175	12.1
56	10 29.0	10 30.7	10 00.3	56	3.9	116	8.0	176	12.2
57	10 29.3	10 31.0	10 00.6	57	3.9	117	8.1	177	12.2
58	10 29.5	10 31.2	10 00.8	58	4.0	118	8.2	178	12.3
59	10 29.8	10 31.5	10 01.1	59	4.1	119	8.2	179	12.4
60	10 30.0	10 31.7	10 01.3	60	4.2	120	8.3	180	12.5

42m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	10 30.0	10 31.7	10 01.3	0	0.0	60	4.3	120	8.5
1	10 30.3	10 32.0	10 01.5	1	0.1	61	4.3	121	8.6
2	10 30.5	10 32.2	10 01.8	2	0.1	62	4.4	122	8.6
3	10 30.8	10 32.5	10 02.0	3	0.2	63	4.5	123	8.7
4	10 31.0	10 32.7	10 02.3	4	0.3	64	4.5	124	8.8
5	10 31.3	10 33.0	10 02.5	5	0.4	65	4.6	125	8.9
6	10 31.5	10 33.2	10 02.7	6	0.4	66	4.7	126	8.9
7	10 31.8	10 33.5	10 03.0	7	0.5	67	4.7	127	9.0
8	10 32.0	10 33.7	10 03.2	8	0.6	68	4.8	128	9.1
9	10 32.3	10 34.0	10 03.4	9	0.6	69	4.9	129	9.1
10	10 32.5	10 34.2	10 03.7	10	0.7	70	5.0	130	9.2
11	10 32.8	10 34.5	10 03.9	11	0.8	71	5.0	131	9.3
12	10 33.0	10 34.7	10 04.2	12	0.9	72	5.1	132	9.4
13	10 33.3	10 35.0	10 04.4	13	0.9	73	5.2	133	9.4
14	10 33.5	10 35.2	10 04.6	14	1.0	74	5.2	134	9.5
15	10 33.8	10 35.5	10 04.9	15	1.1	75	5.3	135	9.6
16	10 34.0	10 35.7	10 05.1	16	1.1	76	5.4	136	9.6
17	10 34.3	10 36.0	10 05.4	17	1.2	77	5.5	137	9.7
18	10 34.5	10 36.2	10 05.6	18	1.3	78	5.5	138	9.8
19	10 34.8	10 36.5	10 05.8	19	1.3	79	5.6	139	9.8
20	10 35.0	10 36.7	10 06.1	20	1.4	80	5.7	140	9.9
21	10 35.3	10 37.0	10 06.3	21	1.5	81	5.7	141	10.0
22	10 35.5	10 37.2	10 06.5	22	1.6	82	5.8	142	10.1
23	10 35.8	10 37.5	10 06.8	23	1.6	83	5.9	143	10.1
24	10 36.0	10 37.7	10 07.0	24	1.7	84	6.0	144	10.2
25	10 36.3	10 38.0	10 07.3	25	1.8	85	6.0	145	10.3
26	10 36.5	10 38.2	10 07.5	26	1.8	86	6.1	146	10.3
27	10 36.8	10 38.5	10 07.7	27	1.9	87	6.2	147	10.4
28	10 37.0	10 38.7	10 08.0	28	2.0	88	6.2	148	10.5
29	10 37.3	10 39.0	10 08.2	29	2.1	89	6.3	149	10.6
30	10 37.5	10 39.2	10 08.5	30	2.1	90	6.4	150	10.6
31	10 37.8	10 39.5	10 08.7	31	2.2	91	6.4	151	10.7
32	10 38.0	10 39.7	10 08.9	32	2.3	92	6.5	152	10.8
33	10 38.3	10 40.0	10 09.2	33	2.3	93	6.6	153	10.8
34	10 38.5	10 40.2	10 09.4	34	2.4	94	6.7	154	10.9
35	10 38.8	10 40.5	10 09.7	35	2.5	95	6.7	155	11.0
36	10 39.0	10 40.7	10 09.9	36	2.6	96	6.8	156	11.1
37	10 39.3	10 41.0	10 10.1	37	2.6	97	6.9	157	11.1
38	10 39.5	10 41.3	10 10.4	38	2.7	98	6.9	158	11.2
39	10 39.8	10 41.5	10 10.6	39	2.8	99	7.0	159	11.3
40	10 40.0	10 41.8	10 10.8	40	2.8	100	7.1	160	11.3
41	10 40.3	10 42.0	10 11.1	41	2.9	101	7.2	161	11.4
42	10 40.5	10 42.3	10 11.3	42	3.0	102	7.2	162	11.5
43	10 40.8	10 42.5	10 11.6	43	3.0	103	7.3	163	11.5
44	10 41.0	10 42.8	10 11.8	44	3.1	104	7.4	164	11.6
45	10 41.3	10 43.0	10 12.0	45	3.2	105	7.4	165	11.7
46	10 41.5	10 43.3	10 12.3	46	3.3	106	7.5	166	11.8
47	10 41.8	10 43.5	10 12.5	47	3.3	107	7.6	167	11.8
48	10 42.0	10 43.8	10 12.8	48	3.4	108	7.7	168	11.9
49	10 42.3	10 44.0	10 13.0	49	3.5	109	7.7	169	12.0
50	10 42.5	10 44.3	10 13.2	50	3.5	110	7.8	170	12.0
51	10 42.8	10 44.5	10 13.5	51	3.6	111	7.9	171	12.1
52	10 43.0	10 44.8	10 13.7	52	3.7	112	7.9	172	12.2
53	10 43.3	10 45.0	10 13.9	53	3.8	113	8.0	173	12.3
54	10 43.5	10 45.3	10 14.2	54	3.8	114	8.1	174	12.3
55	10 43.8	10 45.5	10 14.4	55	3.9	115	8.1	175	12.4
56	10 44.0	10 45.8	10 14.7	56	4.0	116	8.2	176	12.5
57	10 44.3	10 46.0	10 14.9	57	4.0	117	8.3	177	12.5
58	10 44.5	10 46.3	10 15.1	58	4.1	118	8.4	178	12.6
59	10 44.8	10 46.5	10 15.4	59	4.2	119	8.4	179	12.7
60	10 45.0	10 46.8	10 15.6	60	4.3	120	8.5	180	12.8

43m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	10 45.0	10 46.8	10 15.6	0	0.0	60	4.4	120	8.7
1	10 45.3	10 47.0	10 15.9	1	0.1	61	4.4	121	8.8
2	10 45.5	10 47.3	10 16.1	2	0.1	62	4.5	122	8.8
3	10 45.8	10 47.5	10 16.3	3	0.2	63	4.6	123	8.9
4	10 46.0	10 47.8	10 16.6	4	0.3	64	4.6	124	9.0
5	10 46.3	10 48.0	10 16.8	5	0.4	65	4.7	125	9.1
6	10 46.5	10 48.3	10 17.0	6	0.4	66	4.8	126	9.1
7	10 46.8	10 48.5	10 17.3	7	0.5	67	4.9	127	9.2
8	10 47.0	10 48.8	10 17.5	8	0.6	68	4.9	128	9.3
9	10 47.3	10 49.0	10 17.8	9	0.7	69	5.0	129	9.4
10	10 47.5	10 49.3	10 18.0	10	0.7	70	5.1	130	9.4
11	10 47.8	10 49.5	10 18.2	11	0.8	71	5.1	131	9.5
12	10 48.0	10 49.8	10 18.5	12	0.9	72	5.2	132	9.6
13	10 48.3	10 50.0	10 18.7	13	0.9	73	5.3	133	9.6
14	10 48.5	10 50.3	10 19.0	14	1.0	74	5.4	134	9.7
15	10 48.8	10 50.5	10 19.2	15	1.1	75	5.4	135	9.8
16	10 49.0	10 50.8	10 19.4	16	1.2	76	5.5	136	9.9
17	10 49.3	10 51.0	10 19.7	17	1.2	77	5.6	137	9.9
18	10 49.5	10 51.3	10 19.9	18	1.3	78	5.7	138	10.0
19	10 49.8	10 51.5	10 20.2	19	1.4	79	5.7	139	10.1
20	10 50.0	10 51.8	10 20.4	20	1.5	80	5.8	140	10.2
21	10 50.3	10 52.0	10 20.6	21	1.5	81	5.9	141	10.2
22	10 50.5	10 52.3	10 20.9	22	1.6	82	5.9	142	10.3
23	10 50.8	10 52.5	10 21.1	23	1.7	83	6.0	143	10.4
24	10 51.0	10 52.8	10 21.3	24	1.7	84	6.1	144	10.4
25	10 51.3	10 53.0	10 21.6	25	1.8	85	6.2	145	10.5
26	10 51.5	10 53.3	10 21.8	26	1.9	86	6.2	146	10.6
27	10 51.8	10 53.5	10 22.1	27	2.0	87	6.3	147	10.7
28	10 52.0	10 53.8	10 22.3	28	2.0	88	6.4	148	10.7
29	10 52.3	10 54.0	10 22.5	29	2.1	89	6.5	149	10.8
30	10 52.5	10 54.3	10 22.8	30	2.2	90	6.5	150	10.9
31	10 52.8	10 54.5	10 23.0	31	2.2	91	6.6	151	10.9
32	10 53.0	10 54.8	10 23.3	32	2.3	92	6.7	152	11.0
33	10 53.3	10 55.0	10 23.5	33	2.4	93	6.7	153	11.1
34	10 53.5	10 55.3	10 23.7	34	2.5	94	6.8	154	11.2
35	10 53.8	10 55.5	10 24.0	35	2.5	95	6.9	155	11.2
36	10 54.0	10 55.8	10 24.2	36	2.6	96	7.0	156	11.3
37	10 54.3	10 56.0	10 24.4	37	2.7	97	7.0	157	11.4
38	10 54.5	10 56.3	10 24.7	38	2.8	98	7.1	158	11.5
39	10 54.8	10 56.5	10 24.9	39	2.8	99	7.2	159	11.5
40	10 55.0	10 56.8	10 25.2	40	2.9	100	7.3	160	11.6
41	10 55.3	10 57.0	10 25.4	41	3.0	101	7.3	161	11.7
42	10 55.5	10 57.3	10 25.6	42	3.0	102	7.4	162	11.7
43	10 55.8	10 57.5	10 25.9	43	3.1	103	7.5	163	11.8
44	10 56.0	10 57.8	10 26.1	44	3.2	104	7.5	164	11.9
45	10 56.3	10 58.0	10 26.4	45	3.3	105	7.6	165	12.0
46	10 56.5	10 58.3	10 26.6	46	3.3	106	7.7	166	12.0
47	10 56.8	10 58.5	10 26.8	47	3.4	107	7.8	167	12.1
48	10 57.0	10 58.8	10 27.1	48	3.5	108	7.8	168	12.2
49	10 57.3	10 59.0	10 27.3	49	3.6	109	7.9	169	12.3
50	10 57.5	10 59.3	10 27.5	50	3.6	110	8.0	170	12.3
51	10 57.8	10 59.6	10 27.8	51	3.7	111	8.0	171	12.4
52	10 58.0	10 59.8	10 28.0	52	3.8	112	8.1	172	12.5
53	10 58.3	11 00.1	10 28.3	53	3.8	113	8.2	173	12.5
54	10 58.5	11 00.3	10 28.5	54	3.9	114	8.3	174	12.6
55	10 58.8	11 00.6	10 28.7	55	4.0	115	8.3	175	12.7
56	10 59.0	11 00.8	10 29.0	56	4.1	116	8.4	176	12.8
57	10 59.3	11 01.1	10 29.2	57	4.1	117	8.5	177	12.8
58	10 59.5	11 01.3	10 29.5	58	4.2	118	8.6	178	12.9
59	10 59.8	11 01.6	10 29.7	59	4.3	119	8.6	179	13.0
60	11 00.0	11 01.8	10 29.9	60	4.4	120	8.7	180	13.1

44m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	11 00.0	11 01.8	10 29.9	0	0.0	60	4.5	120	8.9
1	11 00.3	11 02.1	10 30.2	1	0.1	61	4.5	121	9.0
2	11 00.5	11 02.3	10 30.4	2	0.1	62	4.6	122	9.0
3	11 00.8	11 02.6	10 30.6	3	0.2	63	4.7	123	9.1
4	11 01.0	11 02.8	10 30.9	4	0.3	64	4.7	124	9.2
5	11 01.3	11 03.1	10 31.1	5	0.4	65	4.8	125	9.3
6	11 01.5	11 03.3	10 31.4	6	0.4	66	4.9	126	9.3
7	11 01.8	11 03.6	10 31.6	7	0.5	67	5.0	127	9.4
8	11 02.0	11 03.8	10 31.8	8	0.6	68	5.0	128	9.5
9	11 02.3	11 04.1	10 32.1	9	0.7	69	5.1	129	9.6
10	11 02.5	11 04.3	10 32.3	10	0.7	70	5.2	130	9.6
11	11 02.8	11 04.6	10 32.6	11	0.8	71	5.3	131	9.7
12	11 03.0	11 04.8	10 32.8	12	0.9	72	5.3	132	9.8
13	11 03.3	11 05.1	10 33.0	13	1.0	73	5.4	133	9.9
14	11 03.5	11 05.3	10 33.3	14	1.0	74	5.5	134	9.9
15	11 03.8	11 05.6	10 33.5	15	1.1	75	5.6	135	10.0
16	11 04.0	11 05.8	10 33.8	16	1.2	76	5.6	136	10.1
17	11 04.3	11 06.1	10 34.0	17	1.3	77	5.7	137	10.2
18	11 04.5	11 06.3	10 34.2	18	1.3	78	5.8	138	10.2
19	11 04.8	11 06.6	10 34.5	19	1.4	79	5.9	139	10.3
20	11 05.0	11 06.8	10 34.7	20	1.5	80	5.9	140	10.4
21	11 05.3	11 07.1	10 34.9	21	1.6	81	6.0	141	10.5
22	11 05.5	11 07.3	10 35.2	22	1.6	82	6.1	142	10.5
23	11 05.8	11 07.6	10 35.4	23	1.7	83	6.2	143	10.6
24	11 06.0	11 07.8	10 35.7	24	1.8	84	6.2	144	10.7
25	11 06.3	11 08.1	10 35.9	25	1.9	85	6.3	145	10.8
26	11 06.5	11 08.3	10 36.1	26	1.9	86	6.4	146	10.8
27	11 06.8	11 08.6	10 36.4	27	2.0	87	6.5	147	10.9
28	11 07.0	11 08.8	10 36.6	28	2.1	88	6.5	148	11.0
29	11 07.3	11 09.1	10 36.9	29	2.2	89	6.6	149	11.1
30	11 07.5	11 09.3	10 37.1	30	2.2	90	6.7	150	11.1
31	11 07.8	11 09.6	10 37.3	31	2.3	91	6.7	151	11.2
32	11 08.0	11 09.8	10 37.6	32	2.4	92	6.8	152	11.3
33	11 08.3	11 10.1	10 37.8	33	2.4	93	6.9	153	11.3
34	11 08.5	11 10.3	10 38.0	34	2.5	94	7.0	154	11.4
35	11 08.8	11 10.6	10 38.3	35	2.6	95	7.0	155	11.5
36	11 09.0	11 10.8	10 38.5	36	2.7	96	7.1	156	11.6
37	11 09.3	11 11.1	10 38.8	37	2.7	97	7.2	157	11.6
38	11 09.5	11 11.3	10 39.0	38	2.8	98	7.3	158	11.7
39	11 09.8	11 11.6	10 39.2	39	2.9	99	7.3	159	11.8
40	11 10.0	11 11.8	10 39.5	40	3.0	100	7.4	160	11.9
41	11 10.3	11 12.1	10 39.7	41	3.0	101	7.5	161	11.9
42	11 10.5	11 12.3	10 40.0	42	3.1	102	7.6	162	12.0
43	11 10.8	11 12.6	10 40.2	43	3.2	103	7.6	163	12.1
44	11 11.0	11 12.8	10 40.4	44	3.3	104	7.7	164	12.2
45	11 11.3	11 13.1	10 40.7	45	3.3	105	7.8	165	12.2
46	11 11.5	11 13.3	10 40.9	46	3.4	106	7.9	166	12.3
47	11 11.8	11 13.6	10 41.1	47	3.5	107	7.9	167	12.4
48	11 12.0	11 13.8	10 41.4	48	3.6	108	8.0	168	12.5
49	11 12.3	11 14.1	10 41.6	49	3.6	109	8.1	169	12.5
50	11 12.5	11 14.3	10 41.9	50	3.7	110	8.2	170	12.6
51	11 12.8	11 14.6	10 42.1	51	3.8	111	8.2	171	12.7
52	11 13.0	11 14.8	10 42.3	52	3.9	112	8.3	172	12.8
53	11 13.3	11 15.1	10 42.6	53	3.9	113	8.4	173	12.8
54	11 13.5	11 15.3	10 42.8	54	4.0	114	8.5	174	12.9
55	11 13.8	11 15.6	10 43.1	55	4.1	115	8.5	175	13.0
56	11 14.0	11 15.8	10 43.3	56	4.2	116	8.6	176	13.1
57	11 14.3	11 16.1	10 43.5	57	4.2	117	8.7	177	13.1
58	11 14.5	11 16.3	10 43.8	58	4.3	118	8.8	178	13.2
59	11 14.8	11 16.6	10 44.0	59	4.4	119	8.8	179	13.3
60	11 15.0	11 16.8	10 44.3	60	4.5	120	8.9	180	13.4

45m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	11 15.0	11 16.8	10 44.3	0	0.0	60	4.6	120	9.1
1	11 15.3	11 17.1	10 44.5	1	0.1	61	4.6	121	9.2
2	11 15.5	11 17.3	10 44.7	2	0.2	62	4.7	122	9.3
3	11 15.8	11 17.6	10 45.0	3	0.2	63	4.8	123	9.3
4	11 16.0	11 17.9	10 45.2	4	0.3	64	4.9	124	9.4
5	11 16.3	11 18.1	10 45.4	5	0.4	65	4.9	125	9.5
6	11 16.5	11 18.4	10 45.7	6	0.5	66	5.0	126	9.6
7	11 16.8	11 18.6	10 45.9	7	0.5	67	5.1	127	9.6
8	11 17.0	11 18.9	10 46.2	8	0.6	68	5.2	128	9.7
9	11 17.3	11 19.1	10 46.4	9	0.7	69	5.2	129	9.8
10	11 17.5	11 19.4	10 46.6	10	0.8	70	5.3	130	9.9
11	11 17.8	11 19.6	10 46.9	11	0.8	71	5.4	131	9.9
12	11 18.0	11 19.9	10 47.1	12	0.9	72	5.5	132	10.0
13	11 18.3	11 20.1	10 47.4	13	1.0	73	5.5	133	10.1
14	11 18.5	11 20.4	10 47.6	14	1.1	74	5.6	134	10.2
15	11 18.8	11 20.6	10 47.8	15	1.1	75	5.7	135	10.2
16	11 19.0	11 20.9	10 48.1	16	1.2	76	5.8	136	10.3
17	11 19.3	11 21.1	10 48.3	17	1.3	77	5.8	137	10.4
18	11 19.5	11 21.4	10 48.5	18	1.4	78	5.9	138	10.5
19	11 19.8	11 21.6	10 48.8	19	1.4	79	6.0	139	10.5
20	11 20.0	11 21.9	10 49.0	20	1.5	80	6.1	140	10.6
21	11 20.3	11 22.1	10 49.3	21	1.6	81	6.1	141	10.7
22	11 20.5	11 22.4	10 49.5	22	1.7	82	6.2	142	10.8
23	11 20.8	11 22.6	10 49.7	23	1.7	83	6.3	143	10.8
24	11 21.0	11 22.9	10 50.0	24	1.8	84	6.4	144	10.9
25	11 21.3	11 23.1	10 50.2	25	1.9	85	6.4	145	11.0
26	11 21.5	11 23.4	10 50.5	26	2.0	86	6.5	146	11.1
27	11 21.8	11 23.6	10 50.7	27	2.0	87	6.6	147	11.1
28	11 22.0	11 23.9	10 50.9	28	2.1	88	6.7	148	11.2
29	11 22.3	11 24.1	10 51.2	29	2.2	89	6.7	149	11.3
30	11 22.5	11 24.4	10 51.4	30	2.3	90	6.8	150	11.4
31	11 22.8	11 24.6	10 51.6	31	2.4	91	6.9	151	11.5
32	11 23.0	11 24.9	10 51.9	32	2.4	92	7.0	152	11.5
33	11 23.3	11 25.1	10 52.1	33	2.5	93	7.1	153	11.6
34	11 23.5	11 25.4	10 52.4	34	2.6	94	7.1	154	11.7
35	11 23.8	11 25.6	10 52.6	35	2.7	95	7.2	155	11.8
36	11 24.0	11 25.9	10 52.8	36	2.7	96	7.3	156	11.8
37	11 24.3	11 26.1	10 53.1	37	2.8	97	7.4	157	11.9
38	11 24.5	11 26.4	10 53.3	38	2.9	98	7.4	158	12.0
39	11 24.8	11 26.6	10 53.6	39	3.0	99	7.5	159	12.1
40	11 25.0	11 26.9	10 53.8	40	3.0	100	7.6	160	12.1
41	11 25.3	11 27.1	10 54.0	41	3.1	101	7.7	161	12.2
42	11 25.5	11 27.4	10 54.3	42	3.2	102	7.7	162	12.3
43	11 25.8	11 27.6	10 54.5	43	3.3	103	7.8	163	12.4
44	11 26.0	11 27.9	10 54.7	44	3.3	104	7.9	164	12.4
45	11 26.3	11 28.1	10 55.0	45	3.4	105	8.0	165	12.5
46	11 26.5	11 28.4	10 55.2	46	3.5	106	8.0	166	12.6
47	11 26.8	11 28.6	10 55.5	47	3.6	107	8.1	167	12.7
48	11 27.0	11 28.9	10 55.7	48	3.6	108	8.2	168	12.7
49	11 27.3	11 29.1	10 55.9	49	3.7	109	8.3	169	12.8
50	11 27.5	11 29.4	10 56.2	50	3.8	110	8.3	170	12.9
51	11 27.8	11 29.6	10 56.4	51	3.9	111	8.4	171	13.0
52	11 28.0	11 29.9	10 56.7	52	3.9	112	8.5	172	13.0
53	11 28.3	11 30.1	10 56.9	53	4.0	113	8.6	173	13.1
54	11 28.5	11 30.4	10 57.1	54	4.1	114	8.6	174	13.2
55	11 28.8	11 30.6	10 57.4	55	4.2	115	8.7	175	13.3
56	11 29.0	11 30.9	10 57.6	56	4.2	116	8.8	176	13.3
57	11 29.3	11 31.1	10 57.9	57	4.3	117	8.9	177	13.4
58	11 29.5	11 31.4	10 58.1	58	4.4	118	8.9	178	13.5
59	11 29.8	11 31.6	10 58.3	59	4.5	119	9.0	179	13.6
60	11 30.0	11 31.9	10 58.6	60	4.6	120	9.1	180	13.7

46m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	11 30.0	11 31.9	10 58.6	0	0.0	60	4.7	120	9.3
1	11 30.3	11 32.1	10 58.8	1	0.1	61	4.7	121	9.4
2	11 30.5	11 32.4	10 59.0	2	0.2	62	4.8	122	9.5
3	11 30.8	11 32.6	10 59.3	3	0.2	63	4.9	123	9.5
4	11 31.0	11 32.9	10 59.5	4	0.3	64	5.0	124	9.6
5	11 31.3	11 33.1	10 59.8	5	0.4	65	5.0	125	9.7
6	11 31.5	11 33.4	11 00.0	6	0.5	66	5.1	126	9.8
7	11 31.8	11 33.6	11 00.2	7	0.5	67	5.2	127	9.8
8	11 32.0	11 33.9	11 00.5	8	0.6	68	5.3	128	9.9
9	11 32.3	11 34.1	11 00.7	9	0.7	69	5.3	129	10.0
10	11 32.5	11 34.4	11 01.0	10	0.8	70	5.4	130	10.1
11	11 32.8	11 34.6	11 01.2	11	0.9	71	5.5	131	10.2
12	11 33.0	11 34.9	11 01.4	12	0.9	72	5.6	132	10.2
13	11 33.3	11 35.1	11 01.7	13	1.0	73	5.7	133	10.3
14	11 33.5	11 35.4	11 01.9	14	1.1	74	5.7	134	10.4
15	11 33.8	11 35.6	11 02.1	15	1.2	75	5.8	135	10.5
16	11 34.0	11 35.9	11 02.4	16	1.2	76	5.9	136	10.5
17	11 34.3	11 36.2	11 02.6	17	1.3	77	6.0	137	10.6
18	11 34.5	11 36.4	11 02.9	18	1.4	78	6.0	138	10.7
19	11 34.8	11 36.7	11 03.1	19	1.5	79	6.1	139	10.8
20	11 35.0	11 36.9	11 03.3	20	1.6	80	6.2	140	10.9
21	11 35.3	11 37.2	11 03.6	21	1.6	81	6.3	141	10.9
22	11 35.5	11 37.4	11 03.8	22	1.7	82	6.4	142	11.0
23	11 35.8	11 37.7	11 04.1	23	1.8	83	6.4	143	11.1
24	11 36.0	11 37.9	11 04.3	24	1.9	84	6.5	144	11.2
25	11 36.3	11 38.2	11 04.5	25	1.9	85	6.6	145	11.2
26	11 36.5	11 38.4	11 04.8	26	2.0	86	6.7	146	11.3
27	11 36.8	11 38.7	11 05.0	27	2.1	87	6.7	147	11.4
28	11 37.0	11 38.9	11 05.2	28	2.2	88	6.8	148	11.5
29	11 37.3	11 39.2	11 05.5	29	2.2	89	6.9	149	11.5
30	11 37.5	11 39.4	11 05.7	30	2.3	90	7.0	150	11.6
31	11 37.8	11 39.7	11 06.0	31	2.4	91	7.1	151	11.7
32	11 38.0	11 39.9	11 06.2	32	2.5	92	7.1	152	11.8
33	11 38.3	11 40.2	11 06.4	33	2.6	93	7.2	153	11.9
34	11 38.5	11 40.4	11 06.7	34	2.6	94	7.3	154	11.9
35	11 38.8	11 40.7	11 06.9	35	2.7	95	7.4	155	12.0
36	11 39.0	11 40.9	11 07.2	36	2.8	96	7.4	156	12.1
37	11 39.3	11 41.2	11 07.4	37	2.9	97	7.5	157	12.2
38	11 39.5	11 41.4	11 07.6	38	2.9	98	7.6	158	12.2
39	11 39.8	11 41.7	11 07.9	39	3.0	99	7.7	159	12.3
40	11 40.0	11 41.9	11 08.1	40	3.1	100	7.8	160	12.4
41	11 40.3	11 42.2	11 08.3	41	3.2	101	7.8	161	12.5
42	11 40.5	11 42.4	11 08.6	42	3.3	102	7.9	162	12.6
43	11 40.8	11 42.7	11 08.8	43	3.3	103	8.0	163	12.6
44	11 41.0	11 42.9	11 09.1	44	3.4	104	8.1	164	12.7
45	11 41.3	11 43.2	11 09.3	45	3.5	105	8.1	165	12.8
46	11 41.5	11 43.4	11 09.5	46	3.6	106	8.2	166	12.9
47	11 41.8	11 43.7	11 09.8	47	3.6	107	8.3	167	12.9
48	11 42.0	11 43.9	11 10.0	48	3.7	108	8.4	168	13.0
49	11 42.3	11 44.2	11 10.3	49	3.8	109	8.4	169	13.1
50	11 42.5	11 44.4	11 10.5	50	3.9	110	8.5	170	13.2
51	11 42.8	11 44.7	11 10.7	51	4.0	111	8.6	171	13.3
52	11 43.0	11 44.9	11 11.0	52	4.0	112	8.7	172	13.3
53	11 43.3	11 45.2	11 11.2	53	4.1	113	8.8	173	13.4
54	11 43.5	11 45.4	11 11.5	54	4.2	114	8.8	174	13.5
55	11 43.8	11 45.7	11 11.7	55	4.3	115	8.9	175	13.6
56	11 44.0	11 45.9	11 11.9	56	4.3	116	9.0	176	13.6
57	11 44.3	11 46.2	11 12.2	57	4.4	117	9.1	177	13.7
58	11 44.5	11 46.4	11 12.4	58	4.5	118	9.1	178	13.8
59	11 44.8	11 46.7	11 12.6	59	4.6	119	9.2	179	13.9
60	11 45.0	11 46.9	11 12.9	60	4.7	120	9.3	180	14.0

47m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	11 45.0	11 46.9	11 12.9	0	0.0	60	4.8	120	9.5
1	11 45.3	11 47.2	11 13.1	1	0.1	61	4.8	121	9.6
2	11 45.5	11 47.4	11 13.4	2	0.2	62	4.9	122	9.7
3	11 45.8	11 47.7	11 13.6	3	0.2	63	5.0	123	9.7
4	11 46.0	11 47.9	11 13.8	4	0.3	64	5.1	124	9.8
5	11 46.3	11 48.2	11 14.1	5	0.4	65	5.1	125	9.9
6	11 46.5	11 48.4	11 14.3	6	0.5	66	5.2	126	10.0
7	11 46.8	11 48.7	11 14.6	7	0.6	67	5.3	127	10.1
8	11 47.0	11 48.9	11 14.8	8	0.6	68	5.4	128	10.1
9	11 47.3	11 49.2	11 15.0	9	0.7	69	5.5	129	10.2
10	11 47.5	11 49.4	11 15.3	10	0.8	70	5.5	130	10.3
11	11 47.8	11 49.7	11 15.5	11	0.9	71	5.6	131	10.4
12	11 48.0	11 49.9	11 15.7	12	1.0	72	5.7	132	10.5
13	11 48.3	11 50.2	11 16.0	13	1.0	73	5.8	133	10.5
14	11 48.5	11 50.4	11 16.2	14	1.1	74	5.9	134	10.6
15	11 48.8	11 50.7	11 16.5	15	1.2	75	5.9	135	10.7
16	11 49.0	11 50.9	11 16.7	16	1.3	76	6.0	136	10.8
17	11 49.3	11 51.2	11 16.9	17	1.3	77	6.1	137	10.8
18	11 49.5	11 51.4	11 17.2	18	1.4	78	6.2	138	10.9
19	11 49.8	11 51.7	11 17.4	19	1.5	79	6.3	139	11.0
20	11 50.0	11 51.9	11 17.7	20	1.6	80	6.3	140	11.1
21	11 50.3	11 52.2	11 17.9	21	1.7	81	6.4	141	11.2
22	11 50.5	11 52.4	11 18.1	22	1.7	82	6.5	142	11.2
23	11 50.8	11 52.7	11 18.4	23	1.8	83	6.6	143	11.3
24	11 51.0	11 52.9	11 18.6	24	1.9	84	6.7	144	11.4
25	11 51.3	11 53.2	11 18.8	25	2.0	85	6.7	145	11.5
26	11 51.5	11 53.4	11 19.1	26	2.1	86	6.8	146	11.6
27	11 51.8	11 53.7	11 19.3	27	2.1	87	6.9	147	11.6
28	11 52.0	11 53.9	11 19.6	28	2.2	88	7.0	148	11.7
29	11 52.3	11 54.2	11 19.8	29	2.3	89	7.0	149	11.8
30	11 52.5	11 54.5	11 20.0	30	2.4	90	7.1	150	11.9
31	11 52.8	11 54.7	11 20.3	31	2.5	91	7.2	151	12.0
32	11 53.0	11 55.0	11 20.5	32	2.5	92	7.3	152	12.0
33	11 53.3	11 55.2	11 20.8	33	2.6	93	7.4	153	12.1
34	11 53.5	11 55.5	11 21.0	34	2.7	94	7.4	154	12.2
35	11 53.8	11 55.7	11 21.2	35	2.8	95	7.5	155	12.3
36	11 54.0	11 56.0	11 21.5	36	2.9	96	7.6	156	12.4
37	11 54.3	11 56.2	11 21.7	37	2.9	97	7.7	157	12.4
38	11 54.5	11 56.5	11 22.0	38	3.0	98	7.8	158	12.5
39	11 54.8	11 56.7	11 22.2	39	3.1	99	7.8	159	12.6
40	11 55.0	11 57.0	11 22.4	40	3.2	100	7.9	160	12.7
41	11 55.3	11 57.2	11 22.7	41	3.2	101	8.0	161	12.7
42	11 55.5	11 57.5	11 22.9	42	3.3	102	8.1	162	12.8
43	11 55.8	11 57.7	11 23.1	43	3.4	103	8.2	163	12.9
44	11 56.0	11 58.0	11 23.4	44	3.5	104	8.2	164	13.0
45	11 56.3	11 58.2	11 23.6	45	3.6	105	8.3	165	13.1
46	11 56.5	11 58.5	11 23.9	46	3.6	106	8.4	166	13.1
47	11 56.8	11 58.7	11 24.1	47	3.7	107	8.5	167	13.2
48	11 57.0	11 59.0	11 24.3	48	3.8	108	8.6	168	13.3
49	11 57.3	11 59.2	11 24.6	49	3.9	109	8.6	169	13.4
50	11 57.5	11 59.5	11 24.8	50	4.0	110	8.7	170	13.5
51	11 57.8	11 59.7	11 25.1	51	4.0	111	8.8	171	13.5
52	11 58.0	12 00.0	11 25.3	52	4.1	112	8.9	172	13.6
53	11 58.3	12 00.2	11 25.5	53	4.2	113	8.9	173	13.7
54	11 58.5	12 00.5	11 25.8	54	4.3	114	9.0	174	13.8
55	11 58.8	12 00.7	11 26.0	55	4.4	115	9.1	175	13.9
56	11 59.0	12 01.0	11 26.2	56	4.4	116	9.2	176	13.9
57	11 59.3	12 01.2	11 26.5	57	4.5	117	9.3	177	14.0
58	11 59.5	12 01.5	11 26.7	58	4.6	118	9.3	178	14.1
59	11 59.8	12 01.7	11 27.0	59	4.7	119	9.4	179	14.2
60	12 00.0	12 02.0	11 27.2	60	4.8	120	9.5	180	14.3

48m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	12 00.0	12 02.0	11 27.2	0	0.0	60	4.9	120	9.7
1	12 00.3	12 02.2	11 27.4	1	0.1	61	4.9	121	9.8
2	12 00.5	12 02.5	11 27.7	2	0.2	62	5.0	122	9.9
3	12 00.8	12 02.7	11 27.9	3	0.2	63	5.1	123	9.9
4	12 01.0	12 03.0	11 28.2	4	0.3	64	5.2	124	10.0
5	12 01.3	12 03.2	11 28.4	5	0.4	65	5.3	125	10.1
6	12 01.5	12 03.5	11 28.6	6	0.5	66	5.3	126	10.2
7	12 01.8	12 03.7	11 28.9	7	0.6	67	5.4	127	10.3
8	12 02.0	12 04.0	11 29.1	8	0.6	68	5.5	128	10.3
9	12 02.3	12 04.2	11 29.3	9	0.7	69	5.6	129	10.4
10	12 02.5	12 04.5	11 29.6	10	0.8	70	5.7	130	10.5
11	12 02.8	12 04.7	11 29.8	11	0.9	71	5.7	131	10.6
12	12 03.0	12 05.0	11 30.1	12	1.0	72	5.8	132	10.7
13	12 03.3	12 05.2	11 30.3	13	1.1	73	5.9	133	10.8
14	12 03.5	12 05.5	11 30.5	14	1.1	74	6.0	134	10.8
15	12 03.8	12 05.7	11 30.8	15	1.2	75	6.1	135	10.9
16	12 04.0	12 06.0	11 31.0	16	1.3	76	6.1	136	11.0
17	12 04.3	12 06.2	11 31.3	17	1.4	77	6.2	137	11.1
18	12 04.5	12 06.5	11 31.5	18	1.5	78	6.3	138	11.2
19	12 04.8	12 06.7	11 31.7	19	1.5	79	6.4	139	11.2
20	12 05.0	12 07.0	11 32.0	20	1.6	80	6.5	140	11.3
21	12 05.3	12 07.2	11 32.2	21	1.7	81	6.5	141	11.4
22	12 05.5	12 07.5	11 32.4	22	1.8	82	6.6	142	11.5
23	12 05.8	12 07.7	11 32.7	23	1.9	83	6.7	143	11.6
24	12 06.0	12 08.0	11 32.9	24	1.9	84	6.8	144	11.6
25	12 06.3	12 08.2	11 33.2	25	2.0	85	6.9	145	11.7
26	12 06.5	12 08.5	11 33.4	26	2.1	86	7.0	146	11.8
27	12 06.8	12 08.7	11 33.6	27	2.2	87	7.0	147	11.9
28	12 07.0	12 09.0	11 33.9	28	2.3	88	7.1	148	12.0
29	12 07.3	12 09.2	11 34.1	29	2.3	89	7.2	149	12.0
30	12 07.5	12 09.5	11 34.4	30	2.4	90	7.3	150	12.1
31	12 07.8	12 09.7	11 34.6	31	2.5	91	7.4	151	12.2
32	12 08.0	12 10.0	11 34.8	32	2.6	92	7.4	152	12.3
33	12 08.3	12 10.2	11 35.1	33	2.7	93	7.5	153	12.4
34	12 08.5	12 10.5	11 35.3	34	2.7	94	7.6	154	12.4
35	12 08.8	12 10.7	11 35.6	35	2.8	95	7.7	155	12.5
36	12 09.0	12 11.0	11 35.8	36	2.9	96	7.8	156	12.6
37	12 09.3	12 11.2	11 36.0	37	3.0	97	7.8	157	12.7
38	12 09.5	12 11.5	11 36.3	38	3.1	98	7.9	158	12.8
39	12 09.8	12 11.7	11 36.5	39	3.2	99	8.0	159	12.9
40	12 10.0	12 12.0	11 36.7	40	3.2	100	8.1	160	12.9
41	12 10.3	12 12.2	11 37.0	41	3.3	101	8.2	161	13.0
42	12 10.5	12 12.5	11 37.2	42	3.4	102	8.2	162	13.1
43	12 10.8	12 12.8	11 37.5	43	3.5	103	8.3	163	13.2
44	12 11.0	12 13.0	11 37.7	44	3.6	104	8.4	164	13.3
45	12 11.3	12 13.3	11 37.9	45	3.6	105	8.5	165	13.3
46	12 11.5	12 13.5	11 38.2	46	3.7	106	8.6	166	13.4
47	12 11.8	12 13.8	11 38.4	47	3.8	107	8.6	167	13.5
48	12 12.0	12 14.0	11 38.7	48	3.9	108	8.7	168	13.6
49	12 12.3	12 14.3	11 38.9	49	4.0	109	8.8	169	13.7
50	12 12.5	12 14.5	11 39.1	50	4.0	110	8.9	170	13.7
51	12 12.8	12 14.8	11 39.4	51	4.1	111	9.0	171	13.8
52	12 13.0	12 15.0	11 39.6	52	4.2	112	9.1	172	13.9
53	12 13.3	12 15.3	11 39.8	53	4.3	113	9.1	173	14.0
54	12 13.5	12 15.5	11 40.1	54	4.4	114	9.2	174	14.1
55	12 13.8	12 15.8	11 40.3	55	4.4	115	9.3	175	14.1
56	12 14.0	12 16.0	11 40.6	56	4.5	116	9.4	176	14.2
57	12 14.3	12 16.3	11 40.8	57	4.6	117	9.5	177	14.3
58	12 14.5	12 16.5	11 41.0	58	4.7	118	9.5	178	14.4
59	12 14.8	12 16.8	11 41.3	59	4.8	119	9.6	179	14.5
60	12 15.0	12 17.0	11 41.5	60	4.9	120	9.7	180	14.6

49m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	12 15.0	12 17.0	11 41.5	0	0.0	60	5.0	120	9.9
1	12 15.3	12 17.3	11 41.8	1	0.1	61	5.0	121	10.0
2	12 15.5	12 17.5	11 42.0	2	0.2	62	5.1	122	10.1
3	12 15.8	12 17.8	11 42.2	3	0.2	63	5.2	123	10.1
4	12 16.0	12 18.0	11 42.5	4	0.3	64	5.3	124	10.2
5	12 16.3	12 18.3	11 42.7	5	0.4	65	5.4	125	10.3
6	12 16.5	12 18.5	11 42.9	6	0.5	66	5.4	126	10.4
7	12 16.8	12 18.8	11 43.2	7	0.6	67	5.5	127	10.5
8	12 17.0	12 19.0	11 43.4	8	0.7	68	5.6	128	10.6
9	12 17.3	12 19.3	11 43.7	9	0.7	69	5.7	129	10.6
10	12 17.5	12 19.5	11 43.9	10	0.8	70	5.8	130	10.7
11	12 17.8	12 19.8	11 44.1	11	0.9	71	5.9	131	10.8
12	12 18.0	12 20.0	11 44.4	12	1.0	72	5.9	132	10.9
13	12 18.3	12 20.3	11 44.6	13	1.1	73	6.0	133	11.0
14	12 18.5	12 20.5	11 44.9	14	1.2	74	6.1	134	11.1
15	12 18.8	12 20.8	11 45.1	15	1.2	75	6.2	135	11.1
16	12 19.0	12 21.0	11 45.3	16	1.3	76	6.3	136	11.2
17	12 19.3	12 21.3	11 45.6	17	1.4	77	6.4	137	11.3
18	12 19.5	12 21.5	11 45.8	18	1.5	78	6.4	138	11.4
19	12 19.8	12 21.8	11 46.1	19	1.6	79	6.5	139	11.5
20	12 20.0	12 22.0	11 46.3	20	1.7	80	6.6	140	11.6
21	12 20.3	12 22.3	11 46.5	21	1.7	81	6.7	141	11.6
22	12 20.5	12 22.5	11 46.8	22	1.8	82	6.8	142	11.7
23	12 20.8	12 22.8	11 47.0	23	1.9	83	6.8	143	11.8
24	12 21.0	12 23.0	11 47.2	24	2.0	84	6.9	144	11.9
25	12 21.3	12 23.3	11 47.5	25	2.1	85	7.0	145	12.0
26	12 21.5	12 23.5	11 47.7	26	2.1	86	7.1	146	12.0
27	12 21.8	12 23.8	11 48.0	27	2.2	87	7.2	147	12.1
28	12 22.0	12 24.0	11 48.2	28	2.3	88	7.3	148	12.2
29	12 22.3	12 24.3	11 48.4	29	2.4	89	7.3	149	12.3
30	12 22.5	12 24.5	11 48.7	30	2.5	90	7.4	150	12.4
31	12 22.8	12 24.8	11 48.9	31	2.6	91	7.5	151	12.5
32	12 23.0	12 25.0	11 49.2	32	2.6	92	7.6	152	12.5
33	12 23.3	12 25.3	11 49.4	33	2.7	93	7.7	153	12.6
34	12 23.5	12 25.5	11 49.6	34	2.8	94	7.8	154	12.7
35	12 23.8	12 25.8	11 49.9	35	2.9	95	7.8	155	12.8
36	12 24.0	12 26.0	11 50.1	36	3.0	96	7.9	156	12.9
37	12 24.3	12 26.3	11 50.3	37	3.1	97	8.0	157	13.0
38	12 24.5	12 26.5	11 50.6	38	3.1	98	8.1	158	13.0
39	12 24.8	12 26.8	11 50.8	39	3.2	99	8.2	159	13.1
40	12 25.0	12 27.0	11 51.1	40	3.3	100	8.3	160	13.2
41	12 25.3	12 27.3	11 51.3	41	3.4	101	8.3	161	13.3
42	12 25.5	12 27.5	11 51.5	42	3.5	102	8.4	162	13.4
43	12 25.8	12 27.8	11 51.8	43	3.5	103	8.5	163	13.4
44	12 26.0	12 28.0	11 52.0	44	3.6	104	8.6	164	13.5
45	12 26.3	12 28.3	11 52.3	45	3.7	105	8.7	165	13.6
46	12 26.5	12 28.5	11 52.5	46	3.8	106	8.7	166	13.7
47	12 26.8	12 28.8	11 52.7	47	3.9	107	8.8	167	13.8
48	12 27.0	12 29.0	11 53.0	48	4.0	108	8.9	168	13.9
49	12 27.3	12 29.3	11 53.2	49	4.0	109	9.0	169	13.9
50	12 27.5	12 29.5	11 53.4	50	4.1	110	9.1	170	14.0
51	12 27.8	12 29.8	11 53.7	51	4.2	111	9.2	171	14.1
52	12 28.0	12 30.0	11 53.9	52	4.3	112	9.2	172	14.2
53	12 28.3	12 30.3	11 54.2	53	4.4	113	9.3	173	14.3
54	12 28.5	12 30.5	11 54.4	54	4.5	114	9.4	174	14.4
55	12 28.8	12 30.8	11 54.6	55	4.5	115	9.5	175	14.4
56	12 29.0	12 31.1	11 54.9	56	4.6	116	9.6	176	14.5
57	12 29.3	12 31.3	11 55.1	57	4.7	117	9.7	177	14.6
58	12 29.5	12 31.6	11 55.4	58	4.8	118	9.7	178	14.7
59	12 29.8	12 31.8	11 55.6	59	4.9	119	9.8	179	14.8
60	12 30.0	12 32.1	11 55.8	60	5.0	120	9.9	180	14.9

50m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	12 30.0	12 32.1	11 55.8	0	0.0	60	5.1	120	10.1
1	12 30.3	12 32.3	11 56.1	1	0.1	61	5.1	121	10.2
2	12 30.5	12 32.6	11 56.3	2	0.2	62	5.2	122	10.3
3	12 30.8	12 32.8	11 56.5	3	0.3	63	5.3	123	10.4
4	12 31.0	12 33.1	11 56.8	4	0.3	64	5.4	124	10.4
5	12 31.3	12 33.3	11 57.0	5	0.4	65	5.5	125	10.5
6	12 31.5	12 33.6	11 57.3	6	0.5	66	5.6	126	10.6
7	12 31.8	12 33.8	11 57.5	7	0.6	67	5.6	127	10.7
8	12 32.0	12 34.1	11 57.7	8	0.7	68	5.7	128	10.8
9	12 32.3	12 34.3	11 58.0	9	0.8	69	5.8	129	10.9
10	12 32.5	12 34.6	11 58.2	10	0.8	70	5.9	130	10.9
11	12 32.8	12 34.8	11 58.5	11	0.9	71	6.0	131	11.0
12	12 33.0	12 35.1	11 58.7	12	1.0	72	6.1	132	11.1
13	12 33.3	12 35.3	11 58.9	13	1.1	73	6.1	133	11.2
14	12 33.5	12 35.6	11 59.2	14	1.2	74	6.2	134	11.3
15	12 33.8	12 35.8	11 59.4	15	1.3	75	6.3	135	11.4
16	12 34.0	12 36.1	11 59.7	16	1.3	76	6.4	136	11.4
17	12 34.3	12 36.3	11 59.9	17	1.4	77	6.5	137	11.5
18	12 34.5	12 36.6	12 00.1	18	1.5	78	6.6	138	11.6
19	12 34.8	12 36.8	12 00.4	19	1.6	79	6.6	139	11.7
20	12 35.0	12 37.1	12 00.6	20	1.7	80	6.7	140	11.8
21	12 35.3	12 37.3	12 00.8	21	1.8	81	6.8	141	11.9
22	12 35.5	12 37.6	12 01.1	22	1.9	82	6.9	142	12.0
23	12 35.8	12 37.8	12 01.3	23	1.9	83	7.0	143	12.0
24	12 36.0	12 38.1	12 01.6	24	2.0	84	7.1	144	12.1
25	12 36.3	12 38.3	12 01.8	25	2.1	85	7.2	145	12.2
26	12 36.5	12 38.6	12 02.0	26	2.2	86	7.2	146	12.3
27	12 36.8	12 38.8	12 02.3	27	2.3	87	7.3	147	12.4
28	12 37.0	12 39.1	12 02.5	28	2.4	88	7.4	148	12.5
29	12 37.3	12 39.3	12 02.8	29	2.4	89	7.5	149	12.5
30	12 37.5	12 39.6	12 03.0	30	2.5	90	7.6	150	12.6
31	12 37.8	12 39.8	12 03.2	31	2.6	91	7.7	151	12.7
32	12 38.0	12 40.1	12 03.5	32	2.7	92	7.7	152	12.8
33	12 38.3	12 40.3	12 03.7	33	2.8	93	7.8	153	12.9
34	12 38.5	12 40.6	12 03.9	34	2.9	94	7.9	154	13.0
35	12 38.8	12 40.8	12 04.2	35	2.9	95	8.0	155	13.0
36	12 39.0	12 41.1	12 04.4	36	3.0	96	8.1	156	13.1
37	12 39.3	12 41.3	12 04.7	37	3.1	97	8.2	157	13.2
38	12 39.5	12 41.6	12 04.9	38	3.2	98	8.2	158	13.3
39	12 39.8	12 41.8	12 05.1	39	3.3	99	8.3	159	13.4
40	12 40.0	12 42.1	12 05.4	40	3.4	100	8.4	160	13.5
41	12 40.3	12 42.3	12 05.6	41	3.5	101	8.5	161	13.6
42	12 40.5	12 42.6	12 05.9	42	3.5	102	8.6	162	13.6
43	12 40.8	12 42.8	12 06.1	43	3.6	103	8.7	163	13.7
44	12 41.0	12 43.1	12 06.3	44	3.7	104	8.8	164	13.8
45	12 41.3	12 43.3	12 06.6	45	3.8	105	8.8	165	13.9
46	12 41.5	12 43.6	12 06.8	46	3.9	106	8.9	166	14.0
47	12 41.8	12 43.8	12 07.0	47	4.0	107	9.0	167	14.1
48	12 42.0	12 44.1	12 07.3	48	4.0	108	9.1	168	14.1
49	12 42.3	12 44.3	12 07.5	49	4.1	109	9.2	169	14.2
50	12 42.5	12 44.6	12 07.8	50	4.2	110	9.3	170	14.3
51	12 42.8	12 44.8	12 08.0	51	4.3	111	9.3	171	14.4
52	12 43.0	12 45.1	12 08.2	52	4.4	112	9.4	172	14.5
53	12 43.3	12 45.3	12 08.5	53	4.5	113	9.5	173	14.6
54	12 43.5	12 45.6	12 08.7	54	4.5	114	9.6	174	14.6
55	12 43.8	12 45.8	12 09.0	55	4.6	115	9.7	175	14.7
56	12 44.0	12 46.1	12 09.2	56	4.7	116	9.8	176	14.8
57	12 44.3	12 46.3	12 09.4	57	4.8	117	9.8	177	14.9
58	12 44.5	12 46.6	12 09.7	58	4.9	118	9.9	178	15.0
59	12 44.8	12 46.8	12 09.9	59	5.0	119	10.0	179	15.1
60	12 45.0	12 47.1	12 10.2	60	5.1	120	10.1	180	15.2

51m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	12 45.0	12 47.1	12 10.2	0	0.0	60	5.2	120	10.3
1	12 45.3	12 47.3	12 10.4	1	0.1	61	5.2	121	10.4
2	12 45.5	12 47.6	12 10.6	2	0.2	62	5.3	122	10.5
3	12 45.8	12 47.8	12 10.9	3	0.3	63	5.4	123	10.6
4	12 46.0	12 48.1	12 11.1	4	0.3	64	5.5	124	10.6
5	12 46.3	12 48.3	12 11.3	5	0.4	65	5.6	125	10.7
6	12 46.5	12 48.6	12 11.6	6	0.5	66	5.7	126	10.8
7	12 46.8	12 48.8	12 11.8	7	0.6	67	5.8	127	10.9
8	12 47.0	12 49.1	12 12.1	8	0.7	68	5.8	128	11.0
9	12 47.3	12 49.4	12 12.3	9	0.8	69	5.9	129	11.1
10	12 47.5	12 49.6	12 12.5	10	0.9	70	6.0	130	11.2
11	12 47.8	12 49.9	12 12.8	11	0.9	71	6.1	131	11.2
12	12 48.0	12 50.1	12 13.0	12	1.0	72	6.2	132	11.3
13	12 48.3	12 50.4	12 13.3	13	1.1	73	6.3	133	11.4
14	12 48.5	12 50.6	12 13.5	14	1.2	74	6.4	134	11.5
15	12 48.8	12 50.9	12 13.7	15	1.3	75	6.4	135	11.6
16	12 49.0	12 51.1	12 14.0	16	1.4	76	6.5	136	11.7
17	12 49.3	12 51.4	12 14.2	17	1.5	77	6.6	137	11.8
18	12 49.5	12 51.6	12 14.4	18	1.5	78	6.7	138	11.8
19	12 49.8	12 51.9	12 14.7	19	1.6	79	6.8	139	11.9
20	12 50.0	12 52.1	12 14.9	20	1.7	80	6.9	140	12.0
21	12 50.3	12 52.4	12 15.2	21	1.8	81	7.0	141	12.1
22	12 50.5	12 52.6	12 15.4	22	1.9	82	7.0	142	12.2
23	12 50.8	12 52.9	12 15.6	23	2.0	83	7.1	143	12.3
24	12 51.0	12 53.1	12 15.9	24	2.1	84	7.2	144	12.4
25	12 51.3	12 53.4	12 16.1	25	2.1	85	7.3	145	12.4
26	12 51.5	12 53.6	12 16.4	26	2.2	86	7.4	146	12.5
27	12 51.8	12 53.9	12 16.6	27	2.3	87	7.5	147	12.6
28	12 52.0	12 54.1	12 16.8	28	2.4	88	7.6	148	12.7
29	12 52.3	12 54.4	12 17.1	29	2.5	89	7.6	149	12.8
30	12 52.5	12 54.6	12 17.3	30	2.6	90	7.7	150	12.9
31	12 52.8	12 54.9	12 17.5	31	2.7	91	7.8	151	13.0
32	12 53.0	12 55.1	12 17.8	32	2.7	92	7.9	152	13.0
33	12 53.3	12 55.4	12 18.0	33	2.8	93	8.0	153	13.1
34	12 53.5	12 55.6	12 18.3	34	2.9	94	8.1	154	13.2
35	12 53.8	12 55.9	12 18.5	35	3.0	95	8.2	155	13.3
36	12 54.0	12 56.1	12 18.7	36	3.1	96	8.2	156	13.4
37	12 54.3	12 56.4	12 19.0	37	3.2	97	8.3	157	13.5
38	12 54.5	12 56.6	12 19.2	38	3.3	98	8.4	158	13.6
39	12 54.8	12 56.9	12 19.5	39	3.3	99	8.5	159	13.6
40	12 55.0	12 57.1	12 19.7	40	3.4	100	8.6	160	13.7
41	12 55.3	12 57.4	12 19.9	41	3.5	101	8.7	161	13.8
42	12 55.5	12 57.6	12 20.2	42	3.6	102	8.8	162	13.9
43	12 55.8	12 57.9	12 20.4	43	3.7	103	8.8	163	14.0
44	12 56.0	12 58.1	12 20.6	44	3.8	104	8.9	164	14.1
45	12 56.3	12 58.4	12 20.9	45	3.9	105	9.0	165	14.2
46	12 56.5	12 58.6	12 21.1	46	3.9	106	9.1	166	14.2
47	12 56.8	12 58.9	12 21.4	47	4.0	107	9.2	167	14.3
48	12 57.0	12 59.1	12 21.6	48	4.1	108	9.3	168	14.4
49	12 57.3	12 59.4	12 21.8	49	4.2	109	9.4	169	14.5
50	12 57.5	12 59.6	12 22.1	50	4.3	110	9.4	170	14.6
51	12 57.8	12 59.9	12 22.3	51	4.4	111	9.5	171	14.7
52	12 58.0	13 00.1	12 22.6	52	4.5	112	9.6	172	14.8
53	12 58.3	13 00.4	12 22.8	53	4.5	113	9.7	173	14.8
54	12 58.5	13 00.6	12 23.0	54	4.6	114	9.8	174	14.9
55	12 58.8	13 00.9	12 23.3	55	4.7	115	9.9	175	15.0
56	12 59.0	13 01.1	12 23.5	56	4.8	116	10.0	176	15.1
57	12 59.3	13 01.4	12 23.8	57	4.9	117	10.0	177	15.2
58	12 59.5	13 01.6	12 24.0	58	5.0	118	10.1	178	15.3
59	12 59.8	13 01.9	12 24.2	59	5.1	119	10.2	179	15.4
60	13 00.0	13 02.1	12 24.5	60	5.2	120	10.3	180	15.5

52m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	13 00.0	13 02.1	12 24.5	0	0.0	60	5.3	120	10.5
1	13 00.3	13 02.4	12 24.7	1	0.1	61	5.3	121	10.6
2	13 00.5	13 02.6	12 24.9	2	0.2	62	5.4	122	10.7
3	13 00.8	13 02.9	12 25.2	3	0.3	63	5.5	123	10.8
4	13 01.0	13 03.1	12 25.4	4	0.4	64	5.6	124	10.9
5	13 01.3	13 03.4	12 25.7	5	0.4	65	5.7	125	10.9
6	13 01.5	13 03.6	12 25.9	6	0.5	66	5.8	126	11.0
7	13 01.8	13 03.9	12 26.1	7	0.6	67	5.9	127	11.1
8	13 02.0	13 04.1	12 26.4	8	0.7	68	6.0	128	11.2
9	13 02.3	13 04.4	12 26.6	9	0.8	69	6.0	129	11.3
10	13 02.5	13 04.6	12 26.9	10	0.9	70	6.1	130	11.4
11	13 02.8	13 04.9	12 27.1	11	1.0	71	6.2	131	11.5
12	13 03.0	13 05.1	12 27.3	12	1.1	72	6.3	132	11.6
13	13 03.3	13 05.4	12 27.6	13	1.1	73	6.4	133	11.6
14	13 03.5	13 05.6	12 27.8	14	1.2	74	6.5	134	11.7
15	13 03.8	13 05.9	12 28.0	15	1.3	75	6.6	135	11.8
16	13 04.0	13 06.1	12 28.3	16	1.4	76	6.7	136	11.9
17	13 04.3	13 06.4	12 28.5	17	1.5	77	6.7	137	12.0
18	13 04.5	13 06.6	12 28.8	18	1.6	78	6.8	138	12.1
19	13 04.8	13 06.9	12 29.0	19	1.7	79	6.9	139	12.2
20	13 05.0	13 07.1	12 29.2	20	1.8	80	7.0	140	12.3
21	13 05.3	13 07.4	12 29.5	21	1.8	81	7.1	141	12.3
22	13 05.5	13 07.7	12 29.7	22	1.9	82	7.2	142	12.4
23	13 05.8	13 07.9	12 30.0	23	2.0	83	7.3	143	12.5
24	13 06.0	13 08.2	12 30.2	24	2.1	84	7.4	144	12.6
25	13 06.3	13 08.4	12 30.4	25	2.2	85	7.4	145	12.7
26	13 06.5	13 08.7	12 30.7	26	2.3	86	7.5	146	12.8
27	13 06.8	13 08.9	12 30.9	27	2.4	87	7.6	147	12.9
28	13 07.0	13 09.2	12 31.1	28	2.5	88	7.7	148	13.0
29	13 07.3	13 09.4	12 31.4	29	2.5	89	7.8	149	13.0
30	13 07.5	13 09.7	12 31.6	30	2.6	90	7.9	150	13.1
31	13 07.8	13 09.9	12 31.9	31	2.7	91	8.0	151	13.2
32	13 08.0	13 10.2	12 32.1	32	2.8	92	8.1	152	13.3
33	13 08.3	13 10.4	12 32.3	33	2.9	93	8.1	153	13.4
34	13 08.5	13 10.7	12 32.6	34	3.0	94	8.2	154	13.5
35	13 08.8	13 10.9	12 32.8	35	3.1	95	8.3	155	13.6
36	13 09.0	13 11.2	12 33.1	36	3.2	96	8.4	156	13.7
37	13 09.3	13 11.4	12 33.3	37	3.2	97	8.5	157	13.7
38	13 09.5	13 11.7	12 33.5	38	3.3	98	8.6	158	13.8
39	13 09.8	13 11.9	12 33.8	39	3.4	99	8.7	159	13.9
40	13 10.0	13 12.2	12 34.0	40	3.5	100	8.8	160	14.0
41	13 10.3	13 12.4	12 34.2	41	3.6	101	8.8	161	14.1
42	13 10.5	13 12.7	12 34.5	42	3.7	102	8.9	162	14.2
43	13 10.8	13 12.9	12 34.7	43	3.8	103	9.0	163	14.3
44	13 11.0	13 13.2	12 35.0	44	3.9	104	9.1	164	14.4
45	13 11.3	13 13.4	12 35.2	45	3.9	105	9.2	165	14.4
46	13 11.5	13 13.7	12 35.4	46	4.0	106	9.3	166	14.5
47	13 11.8	13 13.9	12 35.7	47	4.1	107	9.4	167	14.6
48	13 12.0	13 14.2	12 35.9	48	4.2	108	9.5	168	14.7
49	13 12.3	13 14.4	12 36.2	49	4.3	109	9.5	169	14.8
50	13 12.5	13 14.7	12 36.4	50	4.4	110	9.6	170	14.9
51	13 12.8	13 14.9	12 36.6	51	4.5	111	9.7	171	15.0
52	13 13.0	13 15.2	12 36.9	52	4.6	112	9.8	172	15.1
53	13 13.3	13 15.4	12 37.1	53	4.6	113	9.9	173	15.1
54	13 13.5	13 15.7	12 37.4	54	4.7	114	10.0	174	15.2
55	13 13.8	13 15.9	12 37.6	55	4.8	115	10.1	175	15.3
56	13 14.0	13 16.2	12 37.8	56	4.9	116	10.2	176	15.4
57	13 14.3	13 16.4	12 38.1	57	5.0	117	10.2	177	15.5
58	13 14.5	13 16.7	12 38.3	58	5.1	118	10.3	178	15.6
59	13 14.8	13 16.9	12 38.5	59	5.2	119	10.4	179	15.7
60	13 15.0	13 17.2	12 38.8	60	5.3	120	10.5	180	15.8

53m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	13 15.0	13 17.2	12 38.8	0	0.0	60	5.4	120	10.7
1	13 15.3	13 17.4	12 39.0	1	0.1	61	5.4	121	10.8
2	13 15.5	13 17.7	12 39.3	2	0.2	62	5.5	122	10.9
3	13 15.8	13 17.9	12 39.5	3	0.3	63	5.6	123	11.0
4	13 16.0	13 18.2	12 39.7	4	0.4	64	5.7	124	11.1
5	13 16.3	13 18.4	12 40.0	5	0.4	65	5.8	125	11.1
6	13 16.5	13 18.7	12 40.2	6	0.5	66	5.9	126	11.2
7	13 16.8	13 18.9	12 40.5	7	0.6	67	6.0	127	11.3
8	13 17.0	13 19.2	12 40.7	8	0.7	68	6.1	128	11.4
9	13 17.3	13 19.4	12 40.9	9	0.8	69	6.2	129	11.5
10	13 17.5	13 19.7	12 41.2	10	0.9	70	6.2	130	11.6
11	13 17.8	13 19.9	12 41.4	11	1.0	71	6.3	131	11.7
12	13 18.0	13 20.2	12 41.6	12	1.1	72	6.4	132	11.8
13	13 18.3	13 20.4	12 41.9	13	1.2	73	6.5	133	11.9
14	13 18.5	13 20.7	12 42.1	14	1.2	74	6.6	134	11.9
15	13 18.8	13 20.9	12 42.4	15	1.3	75	6.7	135	12.0
16	13 19.0	13 21.2	12 42.6	16	1.4	76	6.8	136	12.1
17	13 19.3	13 21.4	12 42.8	17	1.5	77	6.9	137	12.2
18	13 19.5	13 21.7	12 43.1	18	1.6	78	7.0	138	12.3
19	13 19.8	13 21.9	12 43.3	19	1.7	79	7.0	139	12.4
20	13 20.0	13 22.2	12 43.6	20	1.8	80	7.1	140	12.5
21	13 20.3	13 22.4	12 43.8	21	1.9	81	7.2	141	12.6
22	13 20.5	13 22.7	12 44.0	22	2.0	82	7.3	142	12.7
23	13 20.8	13 22.9	12 44.3	23	2.1	83	7.4	143	12.8
24	13 21.0	13 23.2	12 44.5	24	2.1	84	7.5	144	12.8
25	13 21.3	13 23.4	12 44.7	25	2.2	85	7.6	145	12.9
26	13 21.5	13 23.7	12 45.0	26	2.3	86	7.7	146	13.0
27	13 21.8	13 23.9	12 45.2	27	2.4	87	7.8	147	13.1
28	13 22.0	13 24.2	12 45.5	28	2.5	88	7.8	148	13.2
29	13 22.3	13 24.4	12 45.7	29	2.6	89	7.9	149	13.3
30	13 22.5	13 24.7	12 45.9	30	2.7	90	8.0	150	13.4
31	13 22.8	13 24.9	12 46.2	31	2.8	91	8.1	151	13.5
32	13 23.0	13 25.2	12 46.4	32	2.9	92	8.2	152	13.6
33	13 23.3	13 25.4	12 46.7	33	2.9	93	8.3	153	13.6
34	13 23.5	13 25.7	12 46.9	34	3.0	94	8.4	154	13.7
35	13 23.8	13 26.0	12 47.1	35	3.1	95	8.5	155	13.8
36	13 24.0	13 26.2	12 47.4	36	3.2	96	8.6	156	13.9
37	13 24.3	13 26.5	12 47.6	37	3.3	97	8.6	157	14.0
38	13 24.5	13 26.7	12 47.9	38	3.4	98	8.7	158	14.1
39	13 24.8	13 27.0	12 48.1	39	3.5	99	8.8	159	14.2
40	13 25.0	13 27.2	12 48.3	40	3.6	100	8.9	160	14.3
41	13 25.3	13 27.5	12 48.6	41	3.7	101	9.0	161	14.4
42	13 25.5	13 27.7	12 48.8	42	3.7	102	9.1	162	14.4
43	13 25.8	13 28.0	12 49.0	43	3.8	103	9.2	163	14.5
44	13 26.0	13 28.2	12 49.3	44	3.9	104	9.3	164	14.6
45	13 26.3	13 28.5	12 49.5	45	4.0	105	9.4	165	14.7
46	13 26.5	13 28.7	12 49.8	46	4.1	106	9.5	166	14.8
47	13 26.8	13 29.0	12 50.0	47	4.2	107	9.5	167	14.9
48	13 27.0	13 29.2	12 50.2	48	4.3	108	9.6	168	15.0
49	13 27.3	13 29.5	12 50.5	49	4.4	109	9.7	169	15.1
50	13 27.5	13 29.7	12 50.7	50	4.5	110	9.8	170	15.2
51	13 27.8	13 30.0	12 51.0	51	4.5	111	9.9	171	15.2
52	13 28.0	13 30.2	12 51.2	52	4.6	112	10.0	172	15.3
53	13 28.3	13 30.5	12 51.4	53	4.7	113	10.1	173	15.4
54	13 28.5	13 30.7	12 51.7	54	4.8	114	10.2	174	15.5
55	13 28.8	13 31.0	12 51.9	55	4.9	115	10.3	175	15.6
56	13 29.0	13 31.2	12 52.1	56	5.0	116	10.3	176	15.7
57	13 29.3	13 31.5	12 52.4	57	5.1	117	10.4	177	15.8
58	13 29.5	13 31.7	12 52.6	58	5.2	118	10.5	178	15.9
59	13 29.8	13 32.0	12 52.9	59	5.3	119	10.6	179	16.0
60	13 30.0	13 32.2	12 53.1	60	5.4	120	10.7	180	16.1

54m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	13 30.0	13 32.2	12 53.1	0	0.0	60	5.5	120	10.9
1	13 30.3	13 32.5	12 53.3	1	0.1	61	5.5	121	11.0
2	13 30.5	13 32.7	12 53.6	2	0.2	62	5.6	122	11.1
3	13 30.8	13 33.0	12 53.8	3	0.3	63	5.7	123	11.2
4	13 31.0	13 33.2	12 54.1	4	0.4	64	5.8	124	11.3
5	13 31.3	13 33.5	12 54.3	5	0.5	65	5.9	125	11.4
6	13 31.5	13 33.7	12 54.5	6	0.5	66	6.0	126	11.4
7	13 31.8	13 34.0	12 54.8	7	0.6	67	6.1	127	11.5
8	13 32.0	13 34.2	12 55.0	8	0.7	68	6.2	128	11.6
9	13 32.3	13 34.5	12 55.2	9	0.8	69	6.3	129	11.7
10	13 32.5	13 34.7	12 55.5	10	0.9	70	6.4	130	11.8
11	13 32.8	13 35.0	12 55.7	11	1.0	71	6.4	131	11.9
12	13 33.0	13 35.2	12 56.0	12	1.1	72	6.5	132	12.0
13	13 33.3	13 35.5	12 56.2	13	1.2	73	6.6	133	12.1
14	13 33.5	13 35.7	12 56.4	14	1.3	74	6.7	134	12.2
15	13 33.8	13 36.0	12 56.7	15	1.4	75	6.8	135	12.3
16	13 34.0	13 36.2	12 56.9	16	1.5	76	6.9	136	12.4
17	13 34.3	13 36.5	12 57.2	17	1.5	77	7.0	137	12.4
18	13 34.5	13 36.7	12 57.4	18	1.6	78	7.1	138	12.5
19	13 34.8	13 37.0	12 57.6	19	1.7	79	7.2	139	12.6
20	13 35.0	13 37.2	12 57.9	20	1.8	80	7.3	140	12.7
21	13 35.3	13 37.5	12 58.1	21	1.9	81	7.4	141	12.8
22	13 35.5	13 37.7	12 58.3	22	2.0	82	7.4	142	12.9
23	13 35.8	13 38.0	12 58.6	23	2.1	83	7.5	143	13.0
24	13 36.0	13 38.2	12 58.8	24	2.2	84	7.6	144	13.1
25	13 36.3	13 38.5	12 59.1	25	2.3	85	7.7	145	13.2
26	13 36.5	13 38.7	12 59.3	26	2.4	86	7.8	146	13.3
27	13 36.8	13 39.0	12 59.5	27	2.5	87	7.9	147	13.4
28	13 37.0	13 39.2	12 59.8	28	2.5	88	8.0	148	13.4
29	13 37.3	13 39.5	13 00.0	29	2.6	89	8.1	149	13.5
30	13 37.5	13 39.7	13 00.3	30	2.7	90	8.2	150	13.6
31	13 37.8	13 40.0	13 00.5	31	2.8	91	8.3	151	13.7
32	13 38.0	13 40.2	13 00.7	32	2.9	92	8.4	152	13.8
33	13 38.3	13 40.5	13 01.0	33	3.0	93	8.4	153	13.9
34	13 38.5	13 40.7	13 01.2	34	3.1	94	8.5	154	14.0
35	13 38.8	13 41.0	13 01.5	35	3.2	95	8.6	155	14.1
36	13 39.0	13 41.2	13 01.7	36	3.3	96	8.7	156	14.2
37	13 39.3	13 41.5	13 01.9	37	3.4	97	8.8	157	14.3
38	13 39.5	13 41.7	13 02.2	38	3.5	98	8.9	158	14.4
39	13 39.8	13 42.0	13 02.4	39	3.5	99	9.0	159	14.4
40	13 40.0	13 42.2	13 02.6	40	3.6	100	9.1	160	14.5
41	13 40.3	13 42.5	13 02.9	41	3.7	101	9.2	161	14.6
42	13 40.5	13 42.7	13 03.1	42	3.8	102	9.3	162	14.7
43	13 40.8	13 43.0	13 03.4	43	3.9	103	9.4	163	14.8
44	13 41.0	13 43.2	13 03.6	44	4.0	104	9.4	164	14.9
45	13 41.3	13 43.5	13 03.8	45	4.1	105	9.5	165	15.0
46	13 41.5	13 43.7	13 04.1	46	4.2	106	9.6	166	15.1
47	13 41.8	13 44.0	13 04.3	47	4.3	107	9.7	167	15.2
48	13 42.0	13 44.3	13 04.6	48	4.4	108	9.8	168	15.3
49	13 42.3	13 44.5	13 04.8	49	4.5	109	9.9	169	15.4
50	13 42.5	13 44.8	13 05.0	50	4.5	110	10.0	170	15.4
51	13 42.8	13 45.0	13 05.3	51	4.6	111	10.1	171	15.5
52	13 43.0	13 45.3	13 05.5	52	4.7	112	10.2	172	15.6
53	13 43.3	13 45.5	13 05.7	53	4.8	113	10.3	173	15.7
54	13 43.5	13 45.8	13 06.0	54	4.9	114	10.4	174	15.8
55	13 43.8	13 46.0	13 06.2	55	5.0	115	10.4	175	15.9
56	13 44.0	13 46.3	13 06.5	56	5.1	116	10.5	176	16.0
57	13 44.3	13 46.5	13 06.7	57	5.2	117	10.6	177	16.1
58	13 44.5	13 46.8	13 06.9	58	5.3	118	10.7	178	16.2
59	13 44.8	13 47.0	13 07.2	59	5.4	119	10.8	179	16.3
60	13 45.0	13 47.3	13 07.4	60	5.5	120	10.9	180	16.4

55m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	13 45.0	13 47.3	13 07.4	0	0.0	60	5.6	120	11.1
1	13 45.3	13 47.5	13 07.7	1	0.1	61	5.6	121	11.2
2	13 45.5	13 47.8	13 07.9	2	0.2	62	5.7	122	11.3
3	13 45.8	13 48.0	13 08.1	3	0.3	63	5.8	123	11.4
4	13 46.0	13 48.3	13 08.4	4	0.4	64	5.9	124	11.5
5	13 46.3	13 48.5	13 08.6	5	0.5	65	6.0	125	11.6
6	13 46.5	13 48.8	13 08.8	6	0.6	66	6.1	126	11.7
7	13 46.8	13 49.0	13 09.1	7	0.6	67	6.2	127	11.7
8	13 47.0	13 49.3	13 09.3	8	0.7	68	6.3	128	11.8
9	13 47.3	13 49.5	13 09.6	9	0.8	69	6.4	129	11.9
10	13 47.5	13 49.8	13 09.8	10	0.9	70	6.5	130	12.0
11	13 47.8	13 50.0	13 10.0	11	1.0	71	6.6	131	12.1
12	13 48.0	13 50.3	13 10.3	12	1.1	72	6.7	132	12.2
13	13 48.3	13 50.5	13 10.5	13	1.2	73	6.8	133	12.3
14	13 48.5	13 50.8	13 10.8	14	1.3	74	6.8	134	12.4
15	13 48.8	13 51.0	13 11.0	15	1.4	75	6.9	135	12.5
16	13 49.0	13 51.3	13 11.2	16	1.5	76	7.0	136	12.6
17	13 49.3	13 51.5	13 11.5	17	1.6	77	7.1	137	12.7
18	13 49.5	13 51.8	13 11.7	18	1.7	78	7.2	138	12.8
19	13 49.8	13 52.0	13 12.0	19	1.8	79	7.3	139	12.9
20	13 50.0	13 52.3	13 12.2	20	1.9	80	7.4	140	13.0
21	13 50.3	13 52.5	13 12.4	21	1.9	81	7.5	141	13.0
22	13 50.5	13 52.8	13 12.7	22	2.0	82	7.6	142	13.1
23	13 50.8	13 53.0	13 12.9	23	2.1	83	7.7	143	13.2
24	13 51.0	13 53.3	13 13.1	24	2.2	84	7.8	144	13.3
25	13 51.3	13 53.5	13 13.4	25	2.3	85	7.9	145	13.4
26	13 51.5	13 53.8	13 13.6	26	2.4	86	8.0	146	13.5
27	13 51.8	13 54.0	13 13.9	27	2.5	87	8.0	147	13.6
28	13 52.0	13 54.3	13 14.1	28	2.6	88	8.1	148	13.7
29	13 52.3	13 54.5	13 14.3	29	2.7	89	8.2	149	13.8
30	13 52.5	13 54.8	13 14.6	30	2.8	90	8.3	150	13.9
31	13 52.8	13 55.0	13 14.8	31	2.9	91	8.4	151	14.0
32	13 53.0	13 55.3	13 15.1	32	3.0	92	8.5	152	14.1
33	13 53.3	13 55.5	13 15.3	33	3.1	93	8.6	153	14.2
34	13 53.5	13 55.8	13 15.5	34	3.1	94	8.7	154	14.2
35	13 53.8	13 56.0	13 15.8	35	3.2	95	8.8	155	14.3
36	13 54.0	13 56.3	13 16.0	36	3.3	96	8.9	156	14.4
37	13 54.3	13 56.5	13 16.2	37	3.4	97	9.0	157	14.5
38	13 54.5	13 56.8	13 16.5	38	3.5	98	9.1	158	14.6
39	13 54.8	13 57.0	13 16.7	39	3.6	99	9.2	159	14.7
40	13 55.0	13 57.3	13 17.0	40	3.7	100	9.3	160	14.8
41	13 55.3	13 57.5	13 17.2	41	3.8	101	9.3	161	14.9
42	13 55.5	13 57.8	13 17.4	42	3.9	102	9.4	162	15.0
43	13 55.8	13 58.0	13 17.7	43	4.0	103	9.5	163	15.1
44	13 56.0	13 58.3	13 17.9	44	4.1	104	9.6	164	15.2
45	13 56.3	13 58.5	13 18.2	45	4.2	105	9.7	165	15.3
46	13 56.5	13 58.8	13 18.4	46	4.3	106	9.8	166	15.4
47	13 56.8	13 59.0	13 18.6	47	4.3	107	9.9	167	15.4
48	13 57.0	13 59.3	13 18.9	48	4.4	108	10.0	168	15.5
49	13 57.3	13 59.5	13 19.1	49	4.5	109	10.1	169	15.6
50	13 57.5	13 59.8	13 19.3	50	4.6	110	10.2	170	15.7
51	13 57.8	14 00.0	13 19.6	51	4.7	111	10.3	171	15.8
52	13 58.0	14 00.3	13 19.8	52	4.8	112	10.4	172	15.9
53	13 58.3	14 00.5	13 20.1	53	4.9	113	10.5	173	16.0
54	13 58.5	14 00.8	13 20.3	54	5.0	114	10.5	174	16.1
55	13 58.8	14 01.0	13 20.5	55	5.1	115	10.6	175	16.2
56	13 59.0	14 01.3	13 20.8	56	5.2	116	10.7	176	16.3
57	13 59.3	14 01.5	13 21.0	57	5.3	117	10.8	177	16.4
58	13 59.5	14 01.8	13 21.3	58	5.4	118	10.9	178	16.5
59	13 59.8	14 02.0	13 21.5	59	5.5	119	11.0	179	16.6
60	14 00.0	14 02.3	13 21.7	60	5.6	120	11.1	180	16.7

56m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	14 00.0	14 02.3	13 21.7	0	0.0	60	5.7	120	11.3
1	14 00.3	14 02.6	13 22.0	1	0.1	61	5.7	121	11.4
2	14 00.5	14 02.8	13 22.2	2	0.2	62	5.8	122	11.5
3	14 00.8	14 03.1	13 22.4	3	0.3	63	5.9	123	11.6
4	14 01.0	14 03.3	13 22.7	4	0.4	64	6.0	124	11.7
5	14 01.3	14 03.6	13 22.9	5	0.5	65	6.1	125	11.8
6	14 01.5	14 03.8	13 23.2	6	0.6	66	6.2	126	11.9
7	14 01.8	14 04.1	13 23.4	7	0.7	67	6.3	127	12.0
8	14 02.0	14 04.3	13 23.6	8	0.8	68	6.4	128	12.1
9	14 02.3	14 04.6	13 23.9	9	0.8	69	6.5	129	12.1
10	14 02.5	14 04.8	13 24.1	10	0.9	70	6.6	130	12.2
11	14 02.8	14 05.1	13 24.4	11	1.0	71	6.7	131	12.3
12	14 03.0	14 05.3	13 24.6	12	1.1	72	6.8	132	12.4
13	14 03.3	14 05.6	13 24.8	13	1.2	73	6.9	133	12.5
14	14 03.5	14 05.8	13 25.1	14	1.3	74	7.0	134	12.6
15	14 03.8	14 06.1	13 25.3	15	1.4	75	7.1	135	12.7
16	14 04.0	14 06.3	13 25.6	16	1.5	76	7.2	136	12.8
17	14 04.3	14 06.6	13 25.8	17	1.6	77	7.3	137	12.9
18	14 04.5	14 06.8	13 26.0	18	1.7	78	7.3	138	13.0
19	14 04.8	14 07.1	13 26.3	19	1.8	79	7.4	139	13.1
20	14 05.0	14 07.3	13 26.5	20	1.9	80	7.5	140	13.2
21	14 05.3	14 07.6	13 26.7	21	2.0	81	7.6	141	13.3
22	14 05.5	14 07.8	13 27.0	22	2.1	82	7.7	142	13.4
23	14 05.8	14 08.1	13 27.2	23	2.2	83	7.8	143	13.5
24	14 06.0	14 08.3	13 27.5	24	2.3	84	7.9	144	13.6
25	14 06.3	14 08.6	13 27.7	25	2.4	85	8.0	145	13.7
26	14 06.5	14 08.8	13 27.9	26	2.4	86	8.1	146	13.7
27	14 06.8	14 09.1	13 28.2	27	2.5	87	8.2	147	13.8
28	14 07.0	14 09.3	13 28.4	28	2.6	88	8.3	148	13.9
29	14 07.3	14 09.6	13 28.7	29	2.7	89	8.4	149	14.0
30	14 07.5	14 09.8	13 28.9	30	2.8	90	8.5	150	14.1
31	14 07.8	14 10.1	13 29.1	31	2.9	91	8.6	151	14.2
32	14 08.0	14 10.3	13 29.4	32	3.0	92	8.7	152	14.3
33	14 08.3	14 10.6	13 29.6	33	3.1	93	8.8	153	14.4
34	14 08.5	14 10.8	13 29.8	34	3.2	94	8.9	154	14.5
35	14 08.8	14 11.1	13 30.1	35	3.3	95	8.9	155	14.6
36	14 09.0	14 11.3	13 30.3	36	3.4	96	9.0	156	14.7
37	14 09.3	14 11.6	13 30.6	37	3.5	97	9.1	157	14.8
38	14 09.5	14 11.8	13 30.8	38	3.6	98	9.2	158	14.9
39	14 09.8	14 12.1	13 31.0	39	3.7	99	9.3	159	15.0
40	14 10.0	14 12.3	13 31.3	40	3.8	100	9.4	160	15.1
41	14 10.3	14 12.6	13 31.5	41	3.9	101	9.5	161	15.2
42	14 10.5	14 12.8	13 31.8	42	4.0	102	9.6	162	15.3
43	14 10.8	14 13.1	13 32.0	43	4.0	103	9.7	163	15.3
44	14 11.0	14 13.3	13 32.2	44	4.1	104	9.8	164	15.4
45	14 11.3	14 13.6	13 32.5	45	4.2	105	9.9	165	15.5
46	14 11.5	14 13.8	13 32.7	46	4.3	106	10.0	166	15.6
47	14 11.8	14 14.1	13 32.9	47	4.4	107	10.1	167	15.7
48	14 12.0	14 14.3	13 33.2	48	4.5	108	10.2	168	15.8
49	14 12.3	14 14.6	13 33.4	49	4.6	109	10.3	169	15.9
50	14 12.5	14 14.8	13 33.7	50	4.7	110	10.4	170	16.0
51	14 12.8	14 15.1	13 33.9	51	4.8	111	10.5	171	16.1
52	14 13.0	14 15.3	13 34.1	52	4.9	112	10.5	172	16.2
53	14 13.3	14 15.6	13 34.4	53	5.0	113	10.6	173	16.3
54	14 13.5	14 15.8	13 34.6	54	5.1	114	10.7	174	16.4
55	14 13.8	14 16.1	13 34.9	55	5.2	115	10.8	175	16.5
56	14 14.0	14 16.3	13 35.1	56	5.3	116	10.9	176	16.6
57	14 14.3	14 16.6	13 35.3	57	5.4	117	11.0	177	16.7
58	14 14.5	14 16.8	13 35.6	58	5.5	118	11.1	178	16.8
59	14 14.8	14 17.1	13 35.8	59	5.6	119	11.2	179	16.9
60	14 15.0	14 17.3	13 36.1	60	5.7	120	11.3	180	17.0

57m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	14 15.0	14 17.3	13 36.1	0	0.0	60	5.8	120	11.5
1	14 15.3	14 17.6	13 36.3	1	0.1	61	5.8	121	11.6
2	14 15.5	14 17.8	13 36.5	2	0.2	62	5.9	122	11.7
3	14 15.8	14 18.1	13 36.8	3	0.3	63	6.0	123	11.8
4	14 16.0	14 18.3	13 37.0	4	0.4	64	6.1	124	11.9
5	14 16.3	14 18.6	13 37.2	5	0.5	65	6.2	125	12.0
6	14 16.5	14 18.8	13 37.5	6	0.6	66	6.3	126	12.1
7	14 16.8	14 19.1	13 37.7	7	0.7	67	6.4	127	12.2
8	14 17.0	14 19.3	13 38.0	8	0.8	68	6.5	128	12.3
9	14 17.3	14 19.6	13 38.2	9	0.9	69	6.6	129	12.4
10	14 17.5	14 19.8	13 38.4	10	1.0	70	6.7	130	12.5
11	14 17.8	14 20.1	13 38.7	11	1.1	71	6.8	131	12.6
12	14 18.0	14 20.3	13 38.9	12	1.2	72	6.9	132	12.7
13	14 18.3	14 20.6	13 39.2	13	1.2	73	7.0	133	12.7
14	14 18.5	14 20.9	13 39.4	14	1.3	74	7.1	134	12.8
15	14 18.8	14 21.1	13 39.6	15	1.4	75	7.2	135	12.9
16	14 19.0	14 21.4	13 39.9	16	1.5	76	7.3	136	13.0
17	14 19.3	14 21.6	13 40.1	17	1.6	77	7.4	137	13.1
18	14 19.5	14 21.9	13 40.3	18	1.7	78	7.5	138	13.2
19	14 19.8	14 22.1	13 40.6	19	1.8	79	7.6	139	13.3
20	14 20.0	14 22.4	13 40.8	20	1.9	80	7.7	140	13.4
21	14 20.3	14 22.6	13 41.1	21	2.0	81	7.8	141	13.5
22	14 20.5	14 22.9	13 41.3	22	2.1	82	7.9	142	13.6
23	14 20.8	14 23.1	13 41.5	23	2.2	83	8.0	143	13.7
24	14 21.0	14 23.4	13 41.8	24	2.3	84	8.1	144	13.8
25	14 21.3	14 23.6	13 42.0	25	2.4	85	8.1	145	13.9
26	14 21.5	14 23.9	13 42.3	26	2.5	86	8.2	146	14.0
27	14 21.8	14 24.1	13 42.5	27	2.6	87	8.3	147	14.1
28	14 22.0	14 24.4	13 42.7	28	2.7	88	8.4	148	14.2
29	14 22.3	14 24.6	13 43.0	29	2.8	89	8.5	149	14.3
30	14 22.5	14 24.9	13 43.2	30	2.9	90	8.6	150	14.4
31	14 22.8	14 25.1	13 43.4	31	3.0	91	8.7	151	14.5
32	14 23.0	14 25.4	13 43.7	32	3.1	92	8.8	152	14.6
33	14 23.3	14 25.6	13 43.9	33	3.2	93	8.9	153	14.7
34	14 23.5	14 25.9	13 44.2	34	3.3	94	9.0	154	14.8
35	14 23.8	14 26.1	13 44.4	35	3.4	95	9.1	155	14.9
36	14 24.0	14 26.4	13 44.6	36	3.5	96	9.2	156	15.0
37	14 24.3	14 26.6	13 44.9	37	3.5	97	9.3	157	15.0
38	14 24.5	14 26.9	13 45.1	38	3.6	98	9.4	158	15.1
39	14 24.8	14 27.1	13 45.4	39	3.7	99	9.5	159	15.2
40	14 25.0	14 27.4	13 45.6	40	3.8	100	9.6	160	15.3
41	14 25.3	14 27.6	13 45.8	41	3.9	101	9.7	161	15.4
42	14 25.5	14 27.9	13 46.1	42	4.0	102	9.8	162	15.5
43	14 25.8	14 28.1	13 46.3	43	4.1	103	9.9	163	15.6
44	14 26.0	14 28.4	13 46.5	44	4.2	104	10.0	164	15.7
45	14 26.3	14 28.6	13 46.8	45	4.3	105	10.1	165	15.8
46	14 26.5	14 28.9	13 47.0	46	4.4	106	10.2	166	15.9
47	14 26.8	14 29.1	13 47.3	47	4.5	107	10.3	167	16.0
48	14 27.0	14 29.4	13 47.5	48	4.6	108	10.4	168	16.1
49	14 27.3	14 29.6	13 47.7	49	4.7	109	10.4	169	16.2
50	14 27.5	14 29.9	13 48.0	50	4.8	110	10.5	170	16.3
51	14 27.8	14 30.1	13 48.2	51	4.9	111	10.6	171	16.4
52	14 28.0	14 30.4	13 48.5	52	5.0	112	10.7	172	16.5
53	14 28.3	14 30.6	13 48.7	53	5.1	113	10.8	173	16.6
54	14 28.5	14 30.9	13 48.9	54	5.2	114	10.9	174	16.7
55	14 28.8	14 31.1	13 49.2	55	5.3	115	11.0	175	16.8
56	14 29.0	14 31.4	13 49.4	56	5.4	116	11.1	176	16.9
57	14 29.3	14 31.6	13 49.7	57	5.5	117	11.2	177	17.0
58	14 29.5	14 31.9	13 49.9	58	5.6	118	11.3	178	17.1
59	14 29.8	14 32.1	13 50.1	59	5.7	119	11.4	179	17.2
60	14 30.0	14 32.4	13 50.4	60	5.8	120	11.5	180	17.3

58m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	14 30.0	14 32.4	13 50.4	0	0.0	60	5.9	120	11.7
1	14 30.3	14 32.6	13 50.6	1	0.1	61	5.9	121	11.8
2	14 30.5	14 32.9	13 50.8	2	0.2	62	6.0	122	11.9
3	14 30.8	14 33.1	13 51.1	3	0.3	63	6.1	123	12.0
4	14 31.0	14 33.4	13 51.3	4	0.4	64	6.2	124	12.1
5	14 31.3	14 33.6	13 51.6	5	0.5	65	6.3	125	12.2
6	14 31.5	14 33.9	13 51.8	6	0.6	66	6.4	126	12.3
7	14 31.8	14 34.1	13 52.0	7	0.7	67	6.5	127	12.4
8	14 32.0	14 34.4	13 52.3	8	0.8	68	6.6	128	12.5
9	14 32.3	14 34.6	13 52.5	9	0.9	69	6.7	129	12.6
10	14 32.5	14 34.9	13 52.8	10	1.0	70	6.8	130	12.7
11	14 32.8	14 35.1	13 53.0	11	1.1	71	6.9	131	12.8
12	14 33.0	14 35.4	13 53.2	12	1.2	72	7.0	132	12.9
13	14 33.3	14 35.6	13 53.5	13	1.3	73	7.1	133	13.0
14	14 33.5	14 35.9	13 53.7	14	1.4	74	7.2	134	13.1
15	14 33.8	14 36.1	13 53.9	15	1.5	75	7.3	135	13.2
16	14 34.0	14 36.4	13 54.2	16	1.6	76	7.4	136	13.3
17	14 34.3	14 36.6	13 54.4	17	1.7	77	7.5	137	13.4
18	14 34.5	14 36.9	13 54.7	18	1.8	78	7.6	138	13.5
19	14 34.8	14 37.1	13 54.9	19	1.9	79	7.7	139	13.6
20	14 35.0	14 37.4	13 55.1	20	2.0	80	7.8	140	13.7
21	14 35.3	14 37.6	13 55.4	21	2.0	81	7.9	141	13.7
22	14 35.5	14 37.9	13 55.6	22	2.1	82	8.0	142	13.8
23	14 35.8	14 38.1	13 55.9	23	2.2	83	8.1	143	13.9
24	14 36.0	14 38.4	13 56.1	24	2.3	84	8.2	144	14.0
25	14 36.3	14 38.6	13 56.3	25	2.4	85	8.3	145	14.1
26	14 36.5	14 38.9	13 56.6	26	2.5	86	8.4	146	14.2
27	14 36.8	14 39.2	13 56.8	27	2.6	87	8.5	147	14.3
28	14 37.0	14 39.4	13 57.0	28	2.7	88	8.6	148	14.4
29	14 37.3	14 39.7	13 57.3	29	2.8	89	8.7	149	14.5
30	14 37.5	14 39.9	13 57.5	30	2.9	90	8.8	150	14.6
31	14 37.8	14 40.2	13 57.8	31	3.0	91	8.9	151	14.7
32	14 38.0	14 40.4	13 58.0	32	3.1	92	9.0	152	14.8
33	14 38.3	14 40.7	13 58.2	33	3.2	93	9.1	153	14.9
34	14 38.5	14 40.9	13 58.5	34	3.3	94	9.2	154	15.0
35	14 38.8	14 41.2	13 58.7	35	3.4	95	9.3	155	15.1
36	14 39.0	14 41.4	13 59.0	36	3.5	96	9.4	156	15.2
37	14 39.3	14 41.7	13 59.2	37	3.6	97	9.5	157	15.3
38	14 39.5	14 41.9	13 59.4	38	3.7	98	9.6	158	15.4
39	14 39.8	14 42.2	13 59.7	39	3.8	99	9.7	159	15.5
40	14 40.0	14 42.4	13 59.9	40	3.9	100	9.8	160	15.6
41	14 40.3	14 42.7	14 00.1	41	4.0	101	9.8	161	15.7
42	14 40.5	14 42.9	14 00.4	42	4.1	102	9.9	162	15.8
43	14 40.8	14 43.2	14 00.6	43	4.2	103	10.0	163	15.9
44	14 41.0	14 43.4	14 00.9	44	4.3	104	10.1	164	16.0
45	14 41.3	14 43.7	14 01.1	45	4.4	105	10.2	165	16.1
46	14 41.5	14 43.9	14 01.3	46	4.5	106	10.3	166	16.2
47	14 41.8	14 44.2	14 01.6	47	4.6	107	10.4	167	16.3
48	14 42.0	14 44.4	14 01.8	48	4.7	108	10.5	168	16.4
49	14 42.3	14 44.7	14 02.1	49	4.8	109	10.6	169	16.5
50	14 42.5	14 44.9	14 02.3	50	4.9	110	10.7	170	16.6
51	14 42.8	14 45.2	14 02.5	51	5.0	111	10.8	171	16.7
52	14 43.0	14 45.4	14 02.8	52	5.1	112	10.9	172	16.8
53	14 43.3	14 45.7	14 03.0	53	5.2	113	11.0	173	16.9
54	14 43.5	14 45.9	14 03.3	54	5.3	114	11.1	174	17.0
55	14 43.8	14 46.2	14 03.5	55	5.4	115	11.2	175	17.1
56	14 44.0	14 46.4	14 03.7	56	5.5	116	11.3	176	17.2
57	14 44.3	14 46.7	14 04.0	57	5.6	117	11.4	177	17.3
58	14 44.5	14 46.9	14 04.2	58	5.7	118	11.5	178	17.4
59	14 44.8	14 47.2	14 04.4	59	5.8	119	11.6	179	17.5
60	14 45.0	14 47.4	14 04.7	60	5.9	120	11.7	180	17.6

59m

Sec.	SUN PLANET	♈	MOON	code	corr'n	code	corr'n	code	corr'n
	° ′	° ′	° ′		′		′		′
0	14 45.0	14 47.4	14 04.7	0	0.0	60	6.0	120	11.9
1	14 45.3	14 47.7	14 04.9	1	0.1	61	6.0	121	12.0
2	14 45.5	14 47.9	14 05.2	2	0.2	62	6.1	122	12.1
3	14 45.8	14 48.2	14 05.4	3	0.3	63	6.2	123	12.2
4	14 46.0	14 48.4	14 05.6	4	0.4	64	6.3	124	12.3
5	14 46.3	14 48.7	14 05.9	5	0.5	65	6.4	125	12.4
6	14 46.5	14 48.9	14 06.1	6	0.6	66	6.5	126	12.5
7	14 46.8	14 49.2	14 06.4	7	0.7	67	6.6	127	12.6
8	14 47.0	14 49.4	14 06.6	8	0.8	68	6.7	128	12.7
9	14 47.3	14 49.7	14 06.8	9	0.9	69	6.8	129	12.8
10	14 47.5	14 49.9	14 07.1	10	1.0	70	6.9	130	12.9
11	14 47.8	14 50.2	14 07.3	11	1.1	71	7.0	131	13.0
12	14 48.0	14 50.4	14 07.5	12	1.2	72	7.1	132	13.1
13	14 48.3	14 50.7	14 07.8	13	1.3	73	7.2	133	13.2
14	14 48.5	14 50.9	14 08.0	14	1.4	74	7.3	134	13.3
15	14 48.8	14 51.2	14 08.3	15	1.5	75	7.4	135	13.4
16	14 49.0	14 51.4	14 08.5	16	1.6	76	7.5	136	13.5
17	14 49.3	14 51.7	14 08.7	17	1.7	77	7.6	137	13.6
18	14 49.5	14 51.9	14 09.0	18	1.8	78	7.7	138	13.7
19	14 49.8	14 52.2	14 09.2	19	1.9	79	7.8	139	13.8
20	14 50.0	14 52.4	14 09.5	20	2.0	80	7.9	140	13.9
21	14 50.3	14 52.7	14 09.7	21	2.1	81	8.0	141	14.0
22	14 50.5	14 52.9	14 09.9	22	2.2	82	8.1	142	14.1
23	14 50.8	14 53.2	14 10.2	23	2.3	83	8.2	143	14.2
24	14 51.0	14 53.4	14 10.4	24	2.4	84	8.3	144	14.3
25	14 51.3	14 53.7	14 10.6	25	2.5	85	8.4	145	14.4
26	14 51.5	14 53.9	14 10.9	26	2.6	86	8.5	146	14.5
27	14 51.8	14 54.2	14 11.1	27	2.7	87	8.6	147	14.6
28	14 52.0	14 54.4	14 11.4	28	2.8	88	8.7	148	14.7
29	14 52.3	14 54.7	14 11.6	29	2.9	89	8.8	149	14.8
30	14 52.5	14 54.9	14 11.8	30	3.0	90	8.9	150	14.9
31	14 52.8	14 55.2	14 12.1	31	3.1	91	9.0	151	15.0
32	14 53.0	14 55.4	14 12.3	32	3.2	92	9.1	152	15.1
33	14 53.3	14 55.7	14 12.6	33	3.3	93	9.2	153	15.2
34	14 53.5	14 55.9	14 12.8	34	3.4	94	9.3	154	15.3
35	14 53.8	14 56.2	14 13.0	35	3.5	95	9.4	155	15.4
36	14 54.0	14 56.4	14 13.3	36	3.6	96	9.5	156	15.5
37	14 54.3	14 56.7	14 13.5	37	3.7	97	9.6	157	15.6
38	14 54.5	14 56.9	14 13.8	38	3.8	98	9.7	158	15.7
39	14 54.8	14 57.2	14 14.0	39	3.9	99	9.8	159	15.8
40	14 55.0	14 57.5	14 14.2	40	4.0	100	9.9	160	15.9
41	14 55.3	14 57.7	14 14.5	41	4.1	101	10.0	161	16.0
42	14 55.5	14 58.0	14 14.7	42	4.2	102	10.1	162	16.1
43	14 55.8	14 58.2	14 14.9	43	4.3	103	10.2	163	16.2
44	14 56.0	14 58.5	14 15.2	44	4.4	104	10.3	164	16.3
45	14 56.3	14 58.7	14 15.4	45	4.5	105	10.4	165	16.4
46	14 56.5	14 59.0	14 15.7	46	4.6	106	10.5	166	16.5
47	14 56.8	14 59.2	14 15.9	47	4.7	107	10.6	167	16.6
48	14 57.0	14 59.5	14 16.1	48	4.8	108	10.7	168	16.7
49	14 57.3	14 59.7	14 16.4	49	4.9	109	10.8	169	16.8
50	14 57.5	15 00.0	14 16.6	50	5.0	110	10.9	170	16.9
51	14 57.8	15 00.2	14 16.9	51	5.1	111	11.0	171	17.0
52	14 58.0	15 00.5	14 17.1	52	5.2	112	11.1	172	17.1
53	14 58.3	15 00.7	14 17.3	53	5.3	113	11.2	173	17.2
54	14 58.5	15 01.0	14 17.6	54	5.4	114	11.3	174	17.3
55	14 58.8	15 01.2	14 17.8	55	5.5	115	11.4	175	17.4
56	14 59.0	15 01.5	14 18.0	56	5.6	116	11.5	176	17.5
57	14 59.3	15 01.7	14 18.3	57	5.7	117	11.6	177	17.6
58	14 59.5	15 02.0	14 18.5	58	5.8	118	11.7	178	17.7
59	14 59.8	15 02.2	14 18.8	59	5.9	119	11.8	179	17.8
60	15 00.0	15 02.5	14 19.0	60	6.0	120	11.9	180	17.9

NAVIGATIONAL STAR CHART

The star chart assists the navigator in identifying stars. The stars of each constellation are connected by dotted lines; the 57 stars given on the daily pages are identified by their names and numbers, and the other navigational stars by their Greek letters. The sidereal hour angle and declination of each star can be determined from the map by means of the network of vertical and horizontal lines. The SHA's are measured (0° to 360°) from the vertical line passing through the Vernal Equinox at 0°. The declinations are measured north and south (+90° to −90°) from the celestial equator which is represented by a heavy horizontal line through the center.

The rectangular shape of the chart distorts the relative positions of the stars in the polar regions. For example the north polar region is distorted so that the pointer stars of the big dipper are not in alignment with Polaris. A globe would give a better representation, and an observer from the inside would see the constellations as they appear in the sky. Then the SHA lines would converge at the north and south poles and the equator and ecliptic would be circles.

An observer's local meridian at any given instant may be located on the chart by means of the SHA coordinates. The basic relation GHA*=GHA♈+SHA* may be written:

$$\text{SHA}^* = \text{GHA}^* - \text{GHA}\ ♈$$

For a star on the meridian the GHA* is equal to the west longitude, whence

$$\text{SHA (local meridian)} = \text{W Long.} - \text{GHA}\ ♈$$

East longitude may be converted into west longitude by subtracting from 360°.

Example: Locate on the chart the local meridian of an observer in longitude 110° W on Jan. 1, at 6^h GMT. From the daily page for Jan. 1, 2, 3, at 6^h, Jan. 1 the GHA ♈=190°. The SHA of his meridian will therefore be 110°+360°−190°=280°.

The identification of a star directly overhead, i. e., in the zenith, is easily made since the point overhead is on the local meridian and also has a Dec. equal to the observer's latitude.

Example: Assume that the observer in the above example is in latitude 40° N and that a star in the zenith is to be identified. The SHA of the star is exactly equal to the SHA of the local meridian and was found to be 280°. The star's Dec. is +40° since the observer's latitude is equal to the Dec. of a point in the zenith.

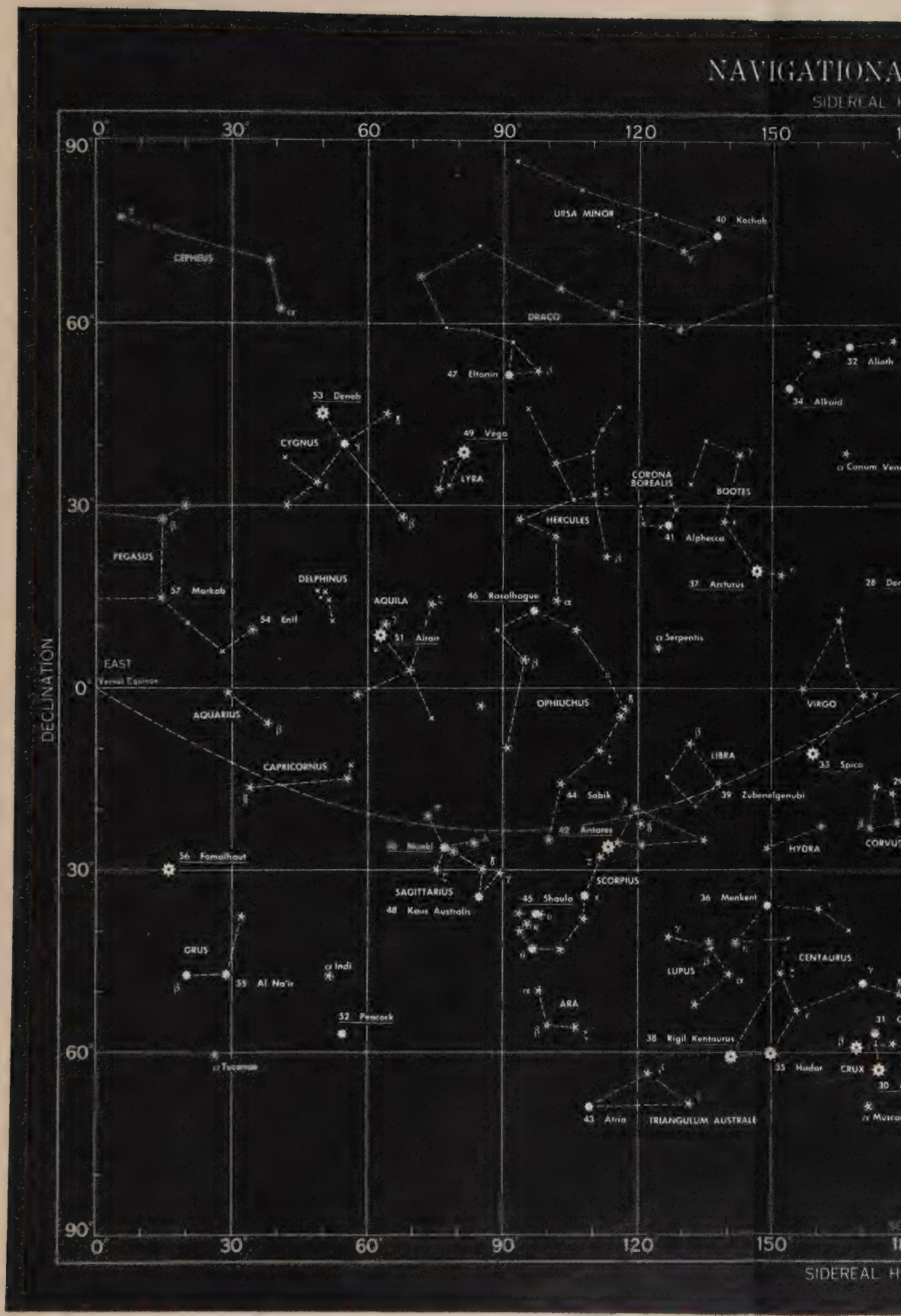
Examination of the chart in the region of SHA=280° and Dec.=+40° shows the brightest star in the region to be the first magnitude star Capella. To verify, this region of the chart may be compared in detail with the sky. One finds the conspicuous triangle formed by the three first magnitude stars Pollux, Aldebaran, and Capella.

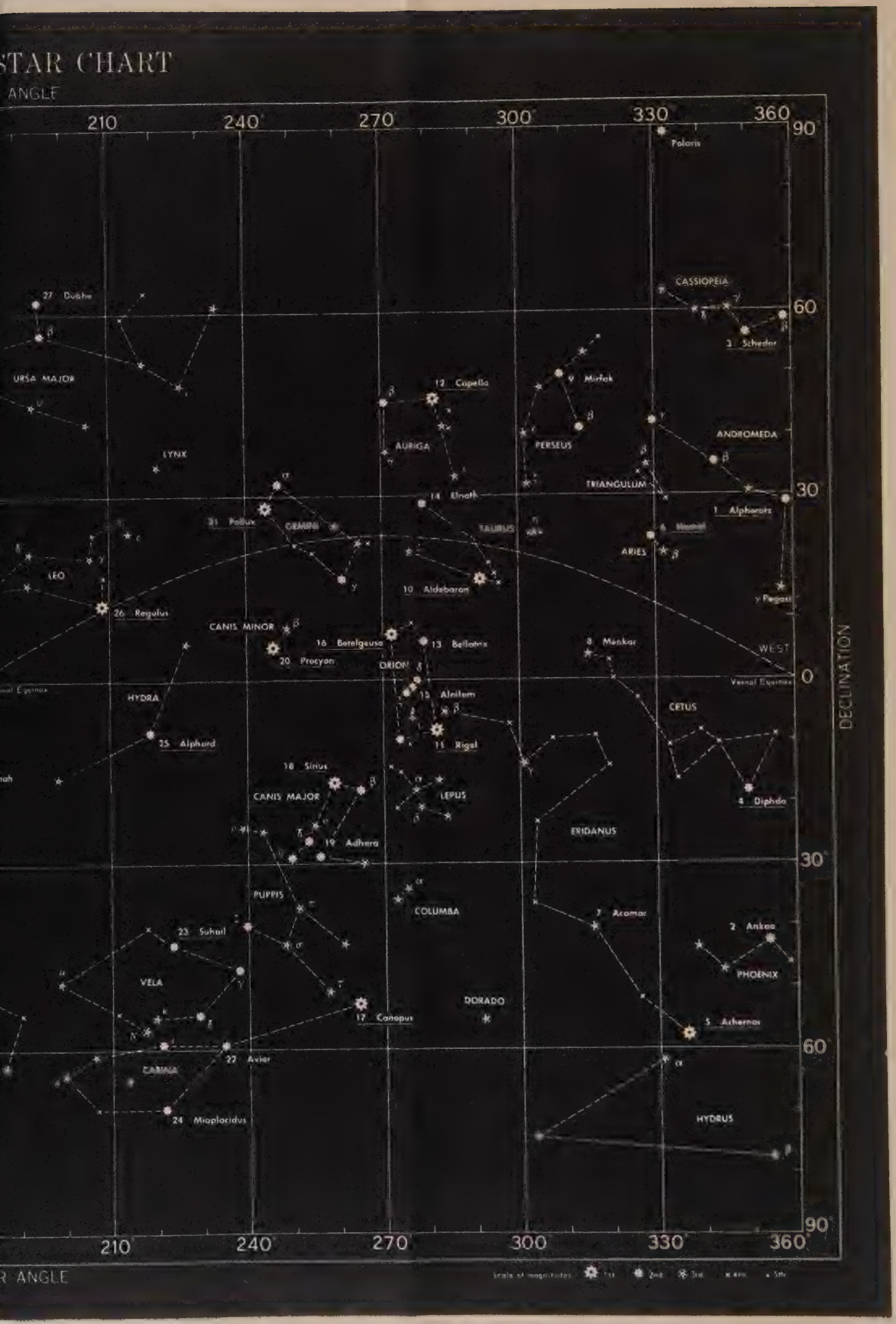
A star to the north or south of the zenith is easily identified because its angular distance from the zenith is equal to the difference between its declination and the observer's latitude. Thus, in the above example, Rigel (Dec.−10°) would appear about 50° south of the zenith or at an altitude of 40°.

The chart may also be used with the "Star Identification Table" in H. O. 214. The table is used to convert an observed altitude and azimuth into Dec. and LHA; the LHA is converted into SHA, and the problem becomes that of the above example, i. e., identification from SHA and Dec. The SHA may be found by adding the LHA, if west, to the SHA of the local meridian and by subtracting it if east.

The ecliptic, which is the path of the Sun among the stars, is represented on the chart by a curved dotted line. The Moon and planets remain always within a few degrees of the ecliptic.

The SHA of a planet can be found by inspection from the daily page. First find the time when the GHA ♈=0°, then the GHA of any object at the corresponding time is also the SHA of that object.


NAVIGATIONA
SIDEREAL
0°
30°
60°
90°
120
150
90°
60°
30°
0°
30°
60°
90°
DECLINATION
EAST
Vernal Equinox
URSA MINOR
40 Kochab
CEPHEUS
DRACO
47 Eltanin
53 Deneb
CYGNUS
49 Vega
LYRA
32 Alioth
34 Alkaid
α Canum Ven
CORONA BOREALIS
BOOTES
HERCULES
41 Alphecca
37 Arcturus
28 Den
PEGASUS
57 Markab
DELPHINUS
54 Enif
AQUILA
51 Altair
46 Rasalhague
α Serpentis
OPHIUCHUS
VIRGO
AQUARIUS
CAPRICORNUS
LIBRA
33 Spica
44 Sabik
39 Zubenelgenubi
42 Antares
HYDRA
CORVUS
56 Fomalhaut
SAGITTARIUS
48 Kaus Australis
SCORPIUS
45 Shaula
36 Menkent
GRUS
55 Al Na'ir
α Indi
52 Peacock
α Tucanae
LUPUS
CENTAURUS
ARA
38 Rigil Kentaurus
35 Hadar
CRUX
43 Atria
TRIANGULUM AUSTRALE
SIDEREAL H


STAR CHART
ANGLE
210
240
270
300
330
360
90
60
30
0
30
60
90
DECLINATION
Polaris
CASSIOPEIA
3 Schedar
27 Dubhe
URSA MAJOR
LYNX
12 Capella
AURIGA
9 Mirfak
PERSEUS
ANDROMEDA
TRIANGULUM
14 Elnath
1 Alpheratz
31 Pollux
GEMINI
TAURUS
6 Hamal
ARIES
γ Pegasi
LEO
10 Aldebaran
26 Regulus
CANIS MINOR
16 Betelgeuse
13 Bellatrix
8 Menkar
20 Procyon
ORION
WEST
Vernal Equinox
HYDRA
15 Alnitam
CETUS
25 Alphard
11 Rigel
18 Sirius
CANIS MAJOR
LEPUS
4 Diphda
19 Adhara
ERIDANUS
PUPPIS
COLUMBA
7 Acamar
23 Suhail
2 Ankaa
PHOENIX
VELA
DORADO
17 Canopus
5 Achernar
22 Avior
CARINA
24 Miaplacidus
HYDRUS
Scale of magnitudes
1st
2nd
3rd
4th
5th

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CORRECTION TO OBSERVED ALTITUDE OF MOON

ADD

Obs. Alt.	0′	8′	15′	23′	30′	38′	45′	53′	60′
°	′	′	′	′	′	′	′	′	′
1	32.6	33.6	34.5	35.3	36.1	36.9	37.6	38.2	
2	38.8	39.4	40.0	40.5	41.0	41.4	41.9	42.3	
3	42.7	43.1	43.4	43.8	44.1	44.4	44.7	45.0	
4	45.2	45.5	45.8	46.0	46.2	46.4	46.6	46.8	
5	47.0	47.2	47.4	47.6	47.7	47.9	48.0	48.2	
6	48.3	48.4	48.6	48.7	48.8	48.9	49.0	49.1	
7	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9	
8	49.9	50.0	50.1	50.2	50.3	50.3	50.4	50.4	
9	50.5	50.5	50.6	50.6	50.7	50.7	50.8	50.8	
10	50.9	50.9	50.9	51.0	51.0	51.0	51.1	51.1	
11	51.1	51.2	51.2	51.2	51.2	51.3	51.3	51.3	
12	51.3	51.3	51.4	51.4	51.4	51.4	51.4	51.4	
13	51.4	51.5	51.5	51.5	51.5	51.5	51.5	51.5	
14	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	
15	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	
16	51.5	51.5	51.4	51.4	51.4	51.4	51.4	51.4	
17	51.4	51.4	51.4	51.3	51.3	51.3	51.3	51.3	
18	51.3	51.2	51.2	51.2	51.2	51.2	51.1	51.1	
19	51.1	51.1	51.1	51.0	51.0	51.0	51.0	50.9	
20	50.9	50.9	50.9	50.8	50.8	50.8	50.8	50.7	
21	50.7	50.7	50.6	50.6	50.6	50.6	50.5	50.5	
22	50.5	50.4	50.4	50.4	50.3	50.3	50.3	50.2	
23	50.2	50.2	50.1	50.1	50.0	50.0	50.0	49.9	
24	49.9	49.9	49.8	49.8	49.7	49.7	49.7	49.6	
25	49.6	49.5	49.5	49.5	49.4	49.4	49.3	49.3	
26	49.2	49.2	49.2	49.1	49.1	49.0	49.0	48.9	
27	48.9	48.8	48.8	48.7	48.7	48.6	48.6	48.5	
28	48.5	48.4	48.4	48.3	48.3	48.2	48.2	48.1	
29	48.1	48.0	48.0	47.9	47.9	47.8	47.8	47.7	
30	47.7	47.6	47.6	47.5	47.5	47.4	47.3	47.3	
31	47.2	47.2	47.1	47.1	47.0	46.9	46.9	46.8	
32	46.8	46.7	46.7	46.6	46.5	46.5	46.4	46.4	
33	46.3	46.2	46.2	46.1	46.0	46.0	45.9	45.9	
34	45.8	45.7	45.7	45.6	45.5	45.5	45.4	45.4	
35	45.3	45.2	45.2	45.1	45.0	45.0	44.9	44.8	
36	44.8	44.7	44.6	44.6	44.5	44.4	44.3	44.3	
37	44.2	44.1	44.1	44.0	43.9	43.9	43.8	43.7	
38	43.7	43.6	43.5	43.4	43.4	43.3	43.2	43.1	
39	43.1	43.0	42.9	42.9	42.8	42.7	42.6	42.6	
40	42.5	42.4	42.3	42.3	42.2	42.1	42.0	42.0	
41	41.9	41.8	41.7	41.6	41.6	41.5	41.4	41.4	
42	41.3	41.2	41.1	41.0	40.9	40.9	40.8	40.7	
43	40.6	40.5	40.5	40.4	40.3	40.2	40.1	40.0	
44	40.0	39.9	39.8	39.7	39.6	39.6	39.5	39.4	
45	39.3	39.2	39.1	39.0	39.0	38.9	38.8	38.7	

Obs. Alt.	0′	8′	15′	23′	30′	38′	45′	53′	60′
°	′	′	′	′	′	′	′	′	
46	38.6	38.5	38.5	38.4	38.3	38.2	38.1	38.0	
47	37.9	37.8	37.8	37.7	37.6	37.5	37.4	37.3	
48	37.2	37.1	37.1	37.0	36.9	36.8	36.7	36.6	
49	36.5	36.4	36.3	36.2	36.2	36.1	36.0	35.9	
50	35.8	35.7	35.6	35.5	35.4	35.3	35.2	35.1	
51	35.0	35.0	34.9	34.8	34.7	34.6	34.5	34.4	
52	34.3	34.2	34.1	34.0	33.9	33.8	33.7	33.6	
53	33.5	33.4	33.3	33.2	33.1	33.0	33.0	32.9	
54	32.8	32.7	32.6	32.5	32.4	32.3	32.2	32.1	
55	32.0	31.9	31.8	31.7	31.6	31.5	31.4	31.3	
56	31.2	31.1	31.0	30.9	30.8	30.7	30.6	30.5	
57	30.4	30.3	30.2	30.1	30.0	29.9	29.8	29.7	
58	29.6	29.4	29.3	29.2	29.1	29.0	28.9	28.8	
59	28.7	28.6	28.5	28.4	28.3	28.2	28.1	28.0	
60	27.9	27.8	27.7	27.6	27.5	27.4	27.3	27.2	
61	27.0	26.9	26.8	26.7	26.6	26.5	26.4	26.3	
62	26.2	26.1	26.0	25.9	25.8	25.7	25.5	25.4	
63	25.3	25.2	25.1	25.0	24.9	24.8	24.7	24.6	
64	24.5	24.4	24.2	24.1	24.0	23.9	23.8	23.7	
65	23.6	23.5	23.4	23.3	23.1	23.0	22.9	22.8	
66	22.7	22.6	22.5	22.4	22.3	22.1	22.0	21.9	
67	21.8	21.7	21.6	21.5	21.4	21.2	21.1	21.0	
68	20.9	20.8	20.7	20.6	20.5	20.3	20.2	20.1	
69	20.0	19.9	19.8	19.7	19.5	19.4	19.3	19.2	
70	19.1	19.0	18.9	18.7	18.6	18.5	18.4	18.3	
71	18.2	18.1	17.9	17.8	17.7	17.6	17.5	17.4	
72	17.2	17.1	17.0	16.9	16.8	16.7	16.5	16.4	
73	16.3	16.2	16.1	16.0	15.8	15.7	15.6	15.5	
74	15.4	15.3	15.1	15.0	14.9	14.8	14.7	14.6	
75	14.4	14.3	14.2	14.1	14.0	13.8	13.7	13.6	
76	13.5	13.4	13.3	13.1	13.0	12.9	12.8	12.7	
77	12.5	12.4	12.3	12.2	12.1	11.9	11.8	11.7	
78	11.6	11.5	11.3	11.2	11.1	11.0	10.9	10.7	
79	10.6	10.5	10.4	10.3	10.1	10.0	9.9	9.8	
80	9.7	9.5	9.4	9.3	9.2	9.1	8.9	8.8	
81	8.7	8.6	8.5	8.3	8.2	8.1	8.0	7.9	
82	7.7	7.6	7.5	7.4	7.2	7.1	7.0	6.9	
83	6.8	6.6	6.5	6.4	6.3	6.2	6.0	5.9	
84	5.8	5.7	5.5	5.4	5.3	5.2	5.1	4.9	
85	4.8	4.7	4.6	4.5	4.3	4.2	4.1	4.0	
86	3.8	3.7	3.6	3.5	3.4	3.2	3.1	3.0	
87	2.9	2.7	2.6	2.5	2.4	2.3	2.1	2.0	
88	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.0	
89	0.9	0.8	0.7	0.5	0.4	0.3	0.2	0.1	

Add to the observed altitude of the Moon's upper limb, lower limb, or center; and apply also the additional correction from the daily page. The degrees of observed altitude are in the column, and the minutes across the top. If the minutes of observed altitude are between 0′.0 and 8′.0, use the first column of corrections; if between 8′.0 and 15′.0, use the second column; etc. If the minutes are exactly 0′.0, 8′.0, 15′.0, etc., use the right-hand column of the two possible.

For height of eye, and corrections for Sun, planets, and stars, see front cover.

STARS

Numerical Order					Order of SHA			
No.	Name	Mag.	SHA	Dec.	SHA	Dec.	No.	Name
			°	°	°	°		
1	Alpheratz	2.2	359	+29	14	+15	57	Markab
2	Ankaa	2.4	354	−42	16	−30	56	Fomalhaut
3	Schedar	2.5	351	+56	29	−47	55	Al Na'ir
4	Diphda[1]	2.2	350	−18	35	+10	54	Enif
5	Achernar	0.6	336	−57	50	+45	53	Deneb
6	Hamal	2.2	329	+23	55	−57	52	Peacock
7	Acamar	3.1	316	−40	63	+ 9	51	Altair
8	Menkar	2.8	315	+ 4	77	−26	50	Nunki
9	Mirfak[2]	1.9	310	+50	81	+39	49	Vega
10	Aldebaran	1.1	292	+16	85	−34	48	Kaus Aust.
11	Rigel	0.3	282	− 8	91	+51	47	Eltanin[8]
12	Capella	0.2	282	+46	97	+13	46	Rasalhague
13	Bellatrix	1.7	279	+ 6	97	−37	45	Shaula
14	Elnath	1.8	279	+28	103	−16	44	Sabik
15	Alnilam	1.8	277	− 1	109	−69	43	Atria[7]
16	Betelgeuse	0.1 to 1.2	272	+ 7	113	−26	42	Antares
17	Canopus	−0.9	264	−53	127	+27	41	Alphecca
18	Sirius	−1.6	259	−17	137	+74	40	Kochab
19	Adhara	1.6	256	−28	138	−16	39	Zubenelgenubi
20	Procyon	0.5	246	+ 5	141	−61	38	Rigil Kent.
21	Pollux	1.2	244	+28	147	+19	37	Arcturus
22	Avior[3]	1.7	235	−59	149	−36	36	Menkent[6]
23	Suhail[4]	2.2	223	−43	150	−60	35	Hadar
24	Miaplacidus	1.8	222	−70	154	+50	34	Alkaid
25	Alphard	2.2	219	− 8	159	−11	33	Spica
26	Regulus	1.3	209	+12	167	+56	32	Alioth
27	Dubhe	2.0	195	+62	173	−57	31	Gacrux[5]
28	Denebola	2.2	183	+15	174	−63	30	Acrux
29	Gienah	2.8	177	−17	177	−17	29	Gienah
30	Acrux	1.1	174	−63	183	+15	28	Denebola
31	Gacrux[5]	1.6	173	−57	195	+62	27	Dubhe
32	Alioth	1.7	167	+56	209	+12	26	Regulus
33	Spica	1.2	159	−11	219	− 8	25	Alphard
34	Alkaid	1.9	154	+50	222	−70	24	Miaplacidus
35	Hadar	0.9	150	−60	223	−43	23	Suhail[4]
36	Menkent[6]	2.3	149	−36	235	−59	22	Avior[3]
37	Arcturus	0.2	147	+19	244	+28	21	Pollux
38	Rigil Kentaurus	0.1	141	−61	246	+ 5	20	Procyon
39	Zubenelgenubi	2.9	138	−16	256	−29	19	Adhara
40	Kochab	2.2	137	+74	259	−17	18	Sirius
41	Alphecca	2.3	127	+27	264	−53	17	Canopus
42	Antares	1.2	113	−26	272	+ 7	16	Betelgeuse
43	Atria[7]	1.9	109	−69	277	− 1	15	Alnilam
44	Sabik	2.6	103	−16	279	+29	14	Elnath
45	Shaula	1.7	97	−37	279	+ 6	13	Bellatrix
46	Rasalhague	2.1	97	+13	282	+46	12	Capella
47	Eltanin[8]	2.4	91	+51	282	− 8	11	Rigel
48	Kaus Australis	2.0	85	−34	292	+16	10	Aldebaran
49	Vega	0.1	81	+39	310	+50	9	Mirfak[2]
50	Nunki	2.1	77	−26	315	+ 4	8	Menkar
51	Altair	0.9	63	+ 9	316	−40	7	Acamar
52	Peacock	2.1	55	−57	329	+23	6	Hamal
53	Deneb	1.3	50	+45	336	−57	5	Achernar
54	Enif	2.5	35	+10	350	−18	4	Diphda[1]
55	Al Na'ir	2.2	29	−47	351	+56	3	Schedar
56	Fomalhaut	1.3	16	−30	354	−42	2	Ankaa
57	Markab	2.6	14	+15	359	+29	1	Alpheratz

[1] Formerly Deneb Kaitos.
[2] Formerly Marfak.
[3] Formerly Epsilon Argus.
[4] Formerly Al Suhail.
[5] Formerly Gamma Crucis.
[6] Formerly Theta Centauri.
[7] Formerly Alpha Tri. Aust.
[8] Formerly Etamin.